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CONTAINER GLASS COMPOSITIONS 1932–1946

By H. MOORE[1] and A. K. LYLE[2]

Hartford-Empire Co., Hartford, Conn.

Introduction

Each year analytical data are accumulated from a large proportion of the container manufacturers in the United States. The individual tabulations are, of course, confidential, but there is a great deal of interesting information in the form of summaries and charts which may be present. While not all of the furnaces engaged in the manufacture of containers are represented in the annual summaries, the size and randomness of the samples would appear to ensure a satisfactory cross-section of the industry.

The purposes of this report are to show the trends of container-glass compositions between 1932 and 1946, and to indicate the range of composition used in 1946.

Container Glasses, 1932-1946

a) Major Oxides. The sampling method used for establishing average compositions consists in selecting analyses from as many sources as available without regard to the number of containers or tons of glass represented by each. It appears, however, from reports of raw material consumption that there would be little difference between weighted and unweighted averages.

In order to simplify the presentation of averages, certain groupings of oxides have been made. Silica is considered alone. Alumina, lime, magnesia, and barium oxide are grouped together as stabilizing oxides. Alkalis, boric oxide, sulfate, and fluorine are combined as fluxes. The averages for these three groupings for each year from 1932 to 1936, alternate years through 1943, and the averages for 1944, 1945 and 1946 are presented in Fig. 1.

The silica content, Fig. 1a, has declined steadily from 74.0 per cent in 1932 to 72.1 per cent in 1945 and 1946. During 1937 a sharp rise occurred, but the downward trend continued the following years.

The total of the stabilizing oxides, Fig. 1b, has increased from about 9.0 per cent in 1932 to 11.9 per cent in 1946. A marked decrease was shown in 1937, but during 1938 a correspondingly larger increase occurred, thus continuing the general trend over the years.

The alkalis plus minor constituents, Fig. 1c, which decreased from about 17.0 per cent to 15.6 per cent between 1932 and 1943, have increased slightly and remained constant at 16.1 per cent during 1944, 1945 and 1946.

Fig. 2 shows the yearly averages for alumina, boric oxide, and barium oxide. It is evident that the changes in the average percentages of the minor constituents have been relatively small. The trends, shown in Fig. 1, therefore, are due chiefly to changes in the percentages of the major constituents—sand, soda and lime. The average percentage of alumina has risen slightly but regularly over the years, apparently leveling off at about 1.8 per cent. The percentage of boric oxide in glasses containing purposely added amounts has decreased steadily from 1934 to 1937, and since then has remained close to 0.5 per cent. The percentage of barium oxide decreased uniformly from 1932 to 1939, and since 1939 has remained close to 0.4 per cent.

b) Minor Oxides. The growth of the use of special added constituents is shown by years in Fig. 3. The use of all four of the minor constituents, except boric oxide, has increased steadily since 1932. During 1934 many manufacturers removed the minor constituents in an ap-

[1]Glass Technologist, Hartford-Empire Co., Hartford, Conn.
[2]Chief Chemist, Hartford-Empire Co., Hartford, Conn.

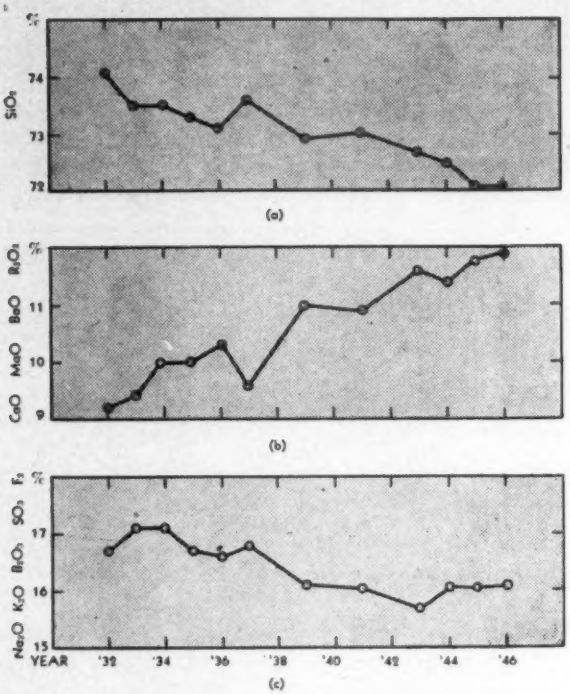


FIG. 1
YEARLY AVERAGES OF THE PERCENTAGES OF THE MAJOR CONSTITUENTS USED IN CONTAINER GLASSES.

parent effort to reduce glass costs, but introduced them again in 1935 presumably because real benefits from their use were experienced.

At present, all glasses contain alumina in quantities exceeding 0.5 per cent, whereas from 1932 to 1937, only about 60 per cent of the glasses contained added alumina. Alumina is used chiefly to improve chemical durability, and, in some instances, to modify working properties.

During 1932 only 10 per cent of the glasses contained barium oxide in amounts greater than 0.05 per cent. From 1933 to 1937 the percentage of glasses containing added barium oxide increased to over 60 per cent. After 1937, further smaller increases were shown until the peak

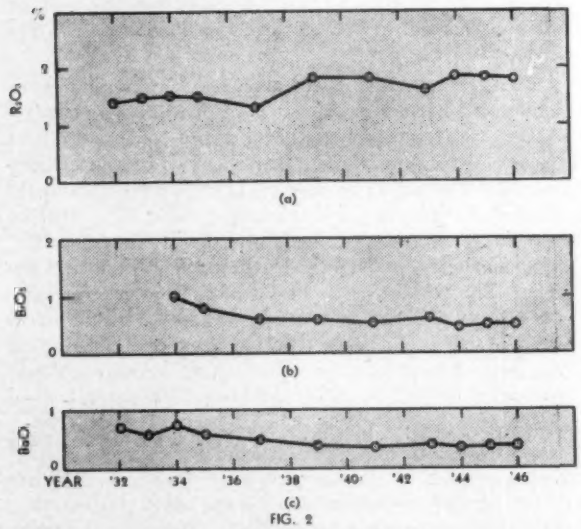


FIG. 2
YEARLY AVERAGES OF THE MINOR CONSTITUENTS USED IN CONTAINER GLASSES.

of about 74 per cent was reached in 1943. In 1946 sixty-four per cent of the glasses contained barium oxide. Barium oxide is generally introduced as barium sulfate or as a natural mixture of barium sulfate and fluorspar. It is used primarily as a fining agent. Because of the adverse effect of sulfates on decolorizers when used in large proportions, barium oxide seldom exceeds 0.5 per cent.

Boric oxide in amounts greater than 0.05 per cent was found in more than 60 per cent of the glasses in 1932, decreasing to 45 per cent by 1940. From 1942 to 1945 the proportion of glasses containing boric oxide again increased to 60 per cent. In 1946 the percentage dropped sharply to 37, the lowest since 1934. The amount of boric oxide generally used ranges between 0.2 and 0.6 per cent, but several container glasses contain more than 1.0 per cent.

From 1932 to 1937 very few glasses contained fluorine in amounts greater than 0.02 per cent. There was a gradual increase in the use of fluorine from 1937 to 1941, and during 1942 glasses containing fluorine soared to 45 per cent. Further increases in the use of fluorine continued to 1945 when 75 per cent of the glasses contained fluorine. Fluorine was found in 61 per cent of the glasses made in 1946. The amount used seldom exceeds 0.3 per cent. Fluorine has a marked effect on melting and fining, and its influence on viscosity is remarkable in view of the small proportions generally used. In many glasses, fluorine is introduced as calcium fluoride (fluorspar). Fluorbarite, phosphate slag, and sodium-silico-fluoride are other common sources of fluorine.

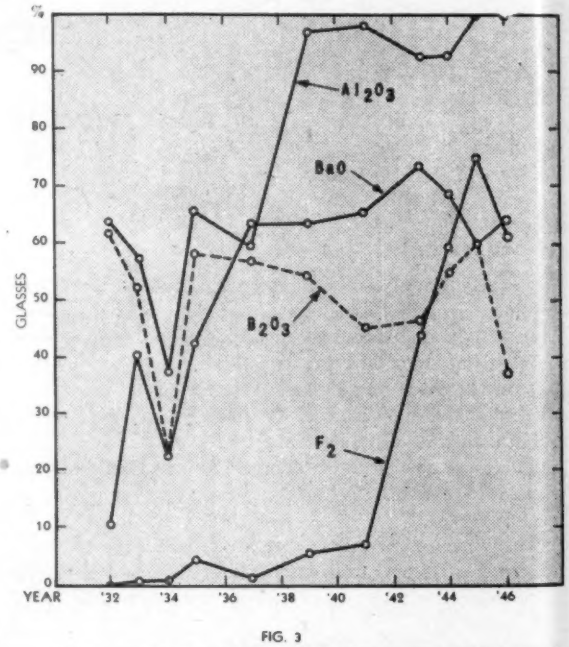
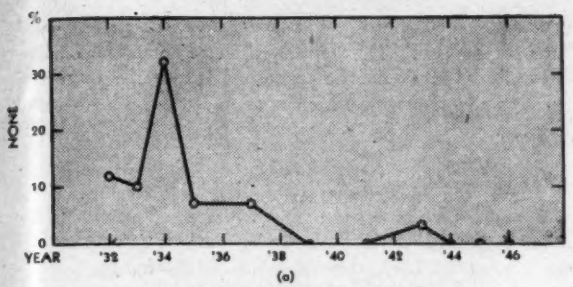


FIG. 3
GLASSES CONTAINING THE FOUR PRINCIPLE MINOR CONSTITUENTS.

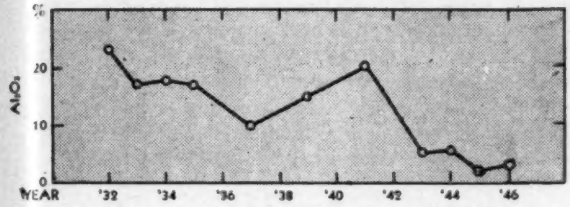
c) Complexity of Glasses. Some glasses contain only one extra constituent, whereas others contain all four. Combinations of two and three minor constituents also occur.

1. None or one extra oxide. Glasses containing none or only one extra constituent are shown in Fig. 4. In 1932 and 1933 about 10 per cent of the glasses were sim-



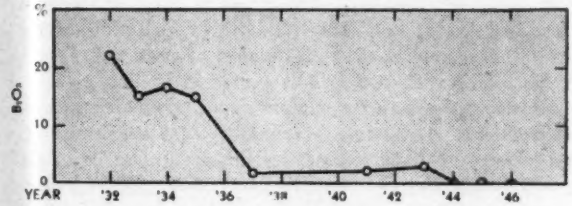
(a)

GLASSES THAT ARE SIMPLE SODA-LIME



(b)

GLASSES CONTAINING ONLY ALUMINA AS AN EXTRA CONSTITUENT



(c)

GLASSES CONTAINING ONLY BORIC OXIDE AS AN EXTRA CONSTITUENT

FIG. 4
PERCENTAGES OF THE GLASSES CONTAINING NONE AND ONE ADDED CONSTITUENT BY YEARS.

ple soda-lime compositions. The general removal of minor constituents in 1934 caused the percentage of simple soda-lime glasses to rise to over 30. The minor constituents were re-introduced in 1935, and, since 1937, with the exception of 1943, no simple soda-lime glasses have been found.

The trend continues towards more complex glasses containing two or more extra constituents.

2. Combinations of two extra oxides. The four minor constituents may occur in six different combinations. The frequency with which these combinations have occurred is shown in Fig. 5.

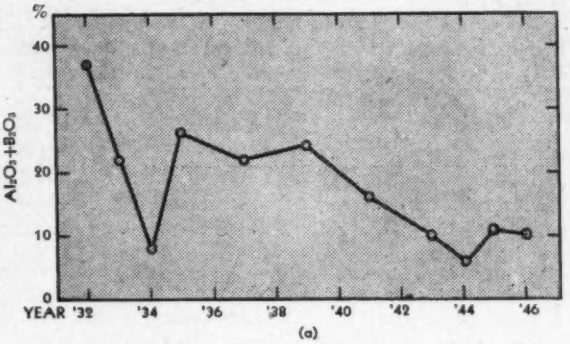
The use of the combination of aluminum and boron oxides, Fig. 5a, has decreased steadily from almost 40 per cent in 1932 to 10 per cent in 1946.

The percentage of glasses containing aluminum and barium oxides, Fig. 5b, has fluctuated throughout the years. The maximum use of this combination occurred in 1941 when it was found in 35 per cent of the glasses. During the period 1942 to 1945, the proportion dropped sharply to about 10 per cent. A rise to 19 per cent was shown in 1946.

The combination of boric and barium oxides, Fig. 5c, has not been found since 1937, and the combination of barium oxide and fluorine has not been found since 1944.

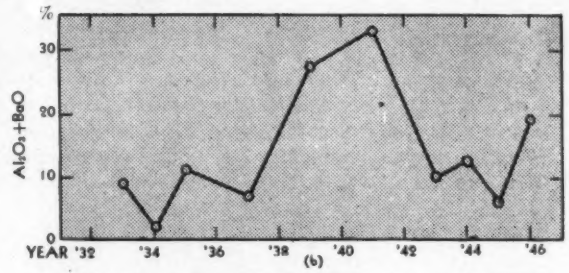
3. Combinations of three and four extra oxides. Combinations of three of the minor constituents may occur in four different ways. The frequency with which these combinations have occurred is shown in Fig. 6.

The use of the combination aluminum, barium, and boron oxides, Fig. 6a, increased steadily from about 8 per cent in 1932 to about 28 per cent in 1939, remaining at this level until 1943. From 1944 to 1946 the percentage of glasses containing this combination dropped to 7 per cent.



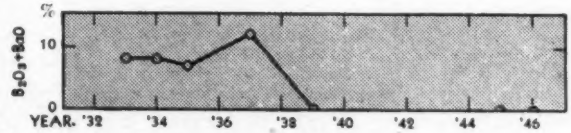
(a)

GLASSES CONTAINING ALUMINUM AND BORON OXIDES



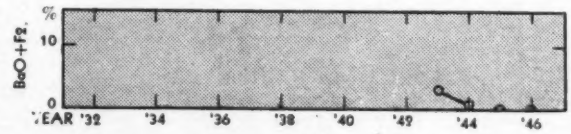
(b)

GLASSES CONTAINING ALUMINUM AND BARIUM OXIDES



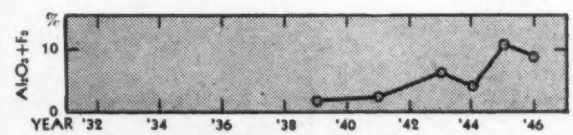
(c)

GLASSES CONTAINING BORON AND BARIUM OXIDES



(d)

GLASSES CONTAINING BARIUM OXIDE AND FLUORINE



(e)

GLASSES CONTAINING ALUMINUM OXIDE AND FLUORINE

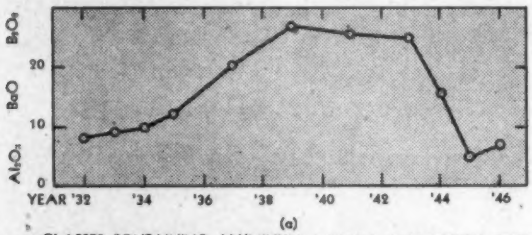
FIG. 5
PERCENTAGES OF THE GLASSES CONTAINING TWO ADDED CONSTITUENTS BY YEARS.

The combination aluminum and barium oxides and fluorine, Fig. 6b, increased from about 3 per cent in 1941 to 31 per cent in 1946. This was the most popular combination found among the 1946 glasses.

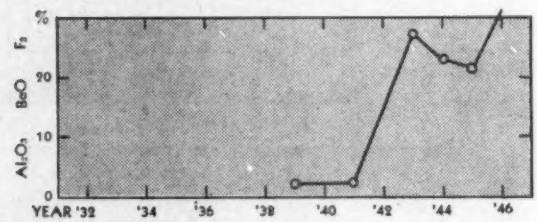
The combination aluminum and boron oxides and fluorine, Fig. 6c, has decreased sharply from 25 per cent in 1945 to only 3 per cent in 1946. This is due almost entirely to a decrease in the use of borax.

The number of glasses containing a combination of all four minor constituents, Fig. 6d, increased steadily from 1941 to 1945, but decreased from about 27 per cent in 1945 to 17 per cent in 1946.

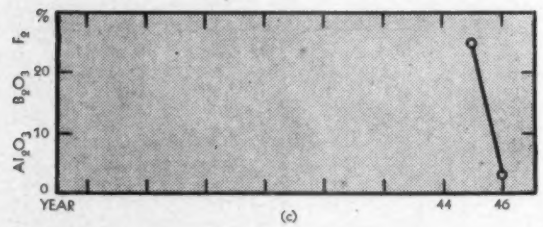
d) Calcite vs. Dolomite. The extent of the use of calcite, dolomite, and mixtures of the two common sources of lime is shown in Fig. 7. There is a continuation of earlier trends in the use of both dolomite and calcite, and in mixtures of the two. At present, about 43 per cent of the glasses are made with dolomite, about 38 per cent with calcite, and 19 per cent using an apparent mixture of the two. The continued increase in the calcite-dolomite mixture may be explained in part by increased use of phosphate slag which is a source of both lime and alumina.



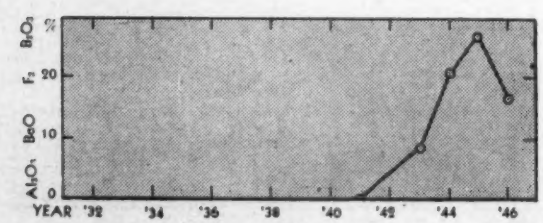
(a)
GLASSES CONTAINING ALUMINUM, BARIUM AND BORON OXIDES



(b)
GLASSES CONTAINING ALUMINUM AND BARIUM OXIDE AND FLUORINE



(c)
GLASSES CONTAINING ALUMINUM, BORIC OXIDE AND FLUORINE



(d)
GLASSES CONTAINING ALUMINUM, BARIUM AND BORIC OXIDE AND FLUORINE

FIG. 6
PERCENTAGES OF THE GLASSES CONTAINING THREE ADDED CONSTITUENTS BY YEARS

1946 Glasses

a) General Comment. The average of compositions manufactured in 1946 is shown in Table I. Compared to the average of 1945, there has been little change.

TABLE I

AVERAGE COMPOSITION OF GLASSES MADE IN 1946

Oxide			%	%
Silica	SiO_2		72.1	72.1
Alumina	R_2O_3		1.8	
Lime and Magnesia	$CaO+MgO$		9.8	11.9
Barium Oxide	BaO		.3	
Alkali	Na_2O+K_2O		15.6	
Boric Oxide	B_2O_3	.2		16.1
Sulfate	SO_3	.2	.5	
Fluorine	F_2	.1		

The percentages of the major constituents used in container glasses, Fig. 1 and Table I, have shown a tendency towards leveling off since 1943. A projection of the trends in percentages of the major constituents, Fig. 1, indicates little change to be expected in 1947.

However, because the soda-ash shortage which became critical during the last few months of 1946 is not reflected in the 1946 glasses, rather large changes in the average composition of 1947 may result. The changes in the major constituents likely to occur are substitutions of silica and lime for alkali. Several glasses of low alkali content were put into extensive use during 1947. These glasses, whose composition ranges are shown in Table II, may be expected to influence future trends in container-glass compositions.

TABLE II

RANGE OF COMPOSITIONS—LOW ALKALI GLASSES

Oxide		*From* %	*To* %
Silica	SiO_2	73.0	73.5
Alumina	R_2O_3	1.5	2.5
Lime and Magnesia	$CaO+MgO$	10.5	12.1
Barium Oxide	BaO	0	0.5
Alkali	Na_2O+K_2O	13.0	14.0
Sulfate	SO_3	0	0.25
Fluorine	F_2	0.20	0.30

b) Range of Compositions: The range of compositions manufactured in 1946 is shown in Figs. 8 and 9, by the distribution charts representing the various oxides. The 1946 data, with the exception of a few isolated results, show the same range of composition as the 1945 glasses.

The silica content, shown in Fig. 8a, ranges from 68.0 to 76.0 per cent. The most common percentage lies between 72.0 and 73.0.

Fig. 8b shows the alumina content normally between 1.0 and 2.5 per cent with some glasses containing as much as 3.5 per cent. Alumina values have become concentrated between 1.0 and 3.0 per cent.

The total of calcium and magnesium oxides, Fig. 8c,

(*Continued on page* 588)

THE PACIFIC COAST A.C.S. REGIONAL MEETING

The pattern of things to come was the theme of the Pacific Coast Regional Meeting held at the Ambassador Hotel in Los Angeles, on October 16 and 17, 1947. Many of the latest developments were described and displayed, the future of the fuel situation was prognosticated by eminent authorities on both gas and oil, electric melting was reviewed, the mathematical approach to service and production problems was discussed by two speakers, and up-to-date methods of control was the subject of a round table discussion. Representatives from both management and production participated in the discussion, and expressed a desire to revive occasional local meetings.

The papers on glass, confined to two sessions, were well diversified, and included economic and theoretical considerations. The chairman of the October 16 sessions was Victor C. Swicker, and Dr. R. R. Shively presided on October 17.

In the first part of his talk, Dr. Shively reviewed and illustrated by slides, modern mechanical devices, including batch charges and bottle-forming machines. He also emphasized the trend towards instrumentation. Dr. Shively then discussed new developments and products, indicating the influence that these developments might have on the future home. Samples of unusual interest that were on display included the Corning Glass Works' contributions—Vycor and Photosensitive glass—baking dishes with high resistance to impact, a "two-way" mirror, and various products made from fiber glass. Of particular interest was the sample of double-glazing supplied by Libbey-Owens-Ford (Thermopane).

The talk by Mr. F. M. Banks, of the Southern California Gas Company, was concise and well to the point. There was excellent representation from other ceramic divisions, due to the fact that this subject is very pertinent to all industries, particularly the glass industry, where changing from gas to oil at very short notice is common occurrence.

Mr. Bank's predictions had a definite optimistic trend. One "Dragon to Slay" was the question as to why 300,000,000 cubic feet of gas a day is put into underground storage. The benefits of this procedure were discussed. Indications point to much greater availability of gas, and by 1949 California industry will be much better protected. Considerable discussion followed this presentation.

The fourth paper of the day was presented by one of California's foremost authorities on the subject of oil—Mr. Frank Ott. Mr. Ott reviewed the specifications of three oils, discussed the availability of heavy oils, made suggestions as to the use of heavy oil, and finally discussed the economics of the situation. This subject matter was timely and very will outlined. Considerable interest in this paper was shown by the audience.

Dr. Toulouse's paper was read by E. R. Owens, manager of the Owens-Illinois (Los Angeles branch), glass plant. The matter of sample size was stressed, and the application to production problems was emphasized. Reference was made to the influence of the "human equation" in so far as it is one of the intangible factors —. A comment from the floor pointed out that a movement is under way by the American Mathematical Society to establish statistics as part of formal education in both secondary schools and colleges. A table showing pertinent reference books and pamphlets was circulated.

The paper entitled "Theory of Behavior of Glassware in Service" by Drs. Glathart and Preston, typifies the application of mathematical consideration to the service performance of glassware. The approach is unique and opens up a new line of thinking. There were some questions by the audience such as (1) How can this method of approach be applied to present problems? (2) Why were tumblers used?

The paper by Dr. Cornelius reviewed the electric melting glass, with particular reference to 1947 performance. Swedish practices were discussed, and considerable data was presented on power requirements. There were numerous questions from the audience.

The final contribution was a round table discussion of glass control methods. Victor C. Swicker reviewed control methods by classifying them into 13 groups, with particular reference to their utility in a container plant. Several controls were discussed, including mechanical, chemical, physical, statistical and visual. The application of chemical analysis and statistical evaluations to the control of composition was reviewed, together with the value of control of composition. Color slides of

cordy glass were shown and the need for a more definite evaluation of the degree of cordiness was stressed. Additional slides shown included re-entrant angles and the associated strains, damage done to bottles at the end of the lehrs, and the effect of poor control of distribution on the strength of beer bottles. There was active participation in this discussion by the group present.

At the well attended banquet Mr. A. Lee Bennett of Gladding, McBean Company, presented several guests and trustees of the society. Mr. Clyde E. Williams, President of American Institute of Mining and Metallurgical Engineers and Director of Batelle Memorial Institute, emphasized the value and need for the same cooperation and good fellowship between societies as now exists between divisions of the same group.

Mr. Millard Sheets, Director of the Art Department, Scripps College, speaking on the "Relation of Design to Industry," told of a changing viewpoint and prophecied a demand for more artistic products as he recalled how American engineers and designers have, in the past, stressed safety and utility rather than beauty. His topic became most thought provoking, as he noted the increasing awareness of the public to a consciousness of the possibilities of better combinations, and reminded us of the great improvement in advertising literature, and especially in the women's magazines of presenting these details. He urged that the ceramic and glass industries prepare to meet this certain demand for artistic as well as useful products.

Papers presented are as follows:

Some Glass Control Methods as they Apply to the Containers' Industry. *Discussion by Victor C. Swicker.*

Glass making is not a "hit or miss" type of manufacture. It is subject to numerous controls and specifications, and the public is the final judge of its performance. Controls and control methods are but applications of good engineering practices, designed to insure efficiency and uniformity in all operations and practices. All controls must consequently serve a useful purpose.

The extent to which methods of control enter into current manufacture shows a remarkable interlacing pattern. A grouping of these controls reveals the extent to which factory observations, technical investigations and research have contributed to modern production. It also suggests that some factories are not taking advantage of many aids to production. It points the way towards partial control of the rather intangible factor—the human element, which too often is blamed for troubles attributable to other sources.

We can control most operations and practices throughout the entire plant providing we take advantage of well-proved methods of control, and if we contribute towards improving these methods.

Slides illustrating controls and control methods are included. The need for improved and better methods is emphasized.

Statistical Control. *By J. H. Toulouse, Owens-Illinois Glass Co., Toledo, Ohio.*

In this paper, Dr. Toulouse discusses the basic principles of the statistical method of quality control and shows how this tool can be applied to glass and ceramic problems. Sampling, sample size and the "normal curve" are discussed in detail and are illustrated by an actual example of the "bead box technique."

Dr. Toulouse states that, "The whole problem of tolerances can be attacked statistically. Most tolerances are artificial and arbitrary, without regard either to needs of the user or the maker of the item. If they are set to what has been shown to be needed—not as has been described as "the smallest measurement the draftsman could think of, divided by two"—it becomes a matter of determining the frequency distribution of the the product and whether the distribution can be kept commercially within the tolerance either as made or by elimination of off-specification units. A wide spread distribution, or a product whose average varies from time to time, will give trouble. A distribution well within the tolerance limits, and kept there, will give little or no trouble."

It was pointed out that the method is not a "test" in itself, but a method of understanding the test. It is not a cure-all, but a sign-post concerning a need for a cure. It does not tell how to remedy a situation, but it does point out more quickly and surely than any other method, that a remedy may be needed. It is a sort of mathematical alarm clock to spur the user to action when, and only when, action is needed. It pays dividends in avoiding unnecessary actions, as well as prompting action when it is necessary. Quoting Dr. Toulouse: "Finally, do not expect the method to do the impossible. It is a tool, whose edge is sharp or dull according to the care taken in its development. Like any other tool, the results depend on the skill of the user and his knowledge of where to apply it."

For those wishing to study this procedure "on their own" the following publications were recommended:

"Statistical Quality Control" by E. L. Grant (McGraw-Hill).

"Control Chart Methods" booklets 31.1, 31.2, and 31.3, American Standards Association, 29 West 39th Street, New York.

"Elementary Statistics and Applications" or "Sampling Statistics and Applications" by Smith and Duncan (McGraw-Hill).

"Mathematics of Statistics" by Kenney (Van Nostrand).

"Applied General Statistics" by Croxton and Cowden (Prentiss-Hall).

"Elements of Statistical Method" by Waugh (McGraw-Hill).

"Economic Control of Quality of Manufactured Product" by Shewhart (Van Nostrand).

"Engineers Manual of Statistical Methods" by Simon (John Wiley).

New Developments in the Glass Industry. *By R. R. Shively, B. F. Drakenfeld & Co., New York, New York.*

This discussion covered new batch handling equipment, developments in batch feeding devices and improvement in increased melting capacity of tanks. Slides were shown illustrating some of the newer forming machines used in the container industry. Samples of tank glass of excellent quality were shown and a brief discussion of improved decorating methods was given.

Samples of new glasses from Owens-Corning Fiberglas, Libbey-Owens-Ford, and Corning Glass Works were on display and their properties discussed. In the samples from Corning there was included a photograph developed on their new photosensitive glass.

Industrial Fuel Oils. *By F. H. Ott, Union Oil Company of California, Los Angeles, California.*

The fuel oils which concern the Pacific coast users are classified into three classes i.e.; PS-200, PS-300 and PS-400.

These fuel oils are given tests to determine their adaptability to the various industrial processes, where heat is used. The tests consist of determining the sulphur content, amount of water and sediment, flash point, carbon residue, ash, BTU content, etc.

Availability of fuel oils is of great concern to Pacific coast users to say nothing of the prevailing costs. Many of our difficulties today are the direct result of the un-natural type of growth. Our total demand for petroleum products is higher today than during the peak of the war.

The West coast statistical position appears to be satisfactory, however, both from the standpoint of supply and local demand.

Theory of Behavior of Glassware in Service. *By J. T. Glathart and F. W. Preston, Read by V. C. Swicker, Preston Laboratories, Butler, Pa.*

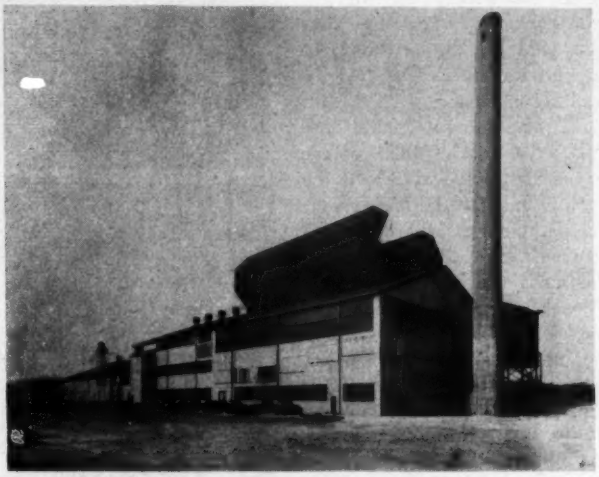
Serviceability, the most important characteristic of a glass

(*Continued on page* 600)

MODERN EQUIPMENT AND LAYOUT DISTINGUISH THE NEVILLE ISLAND PLANT

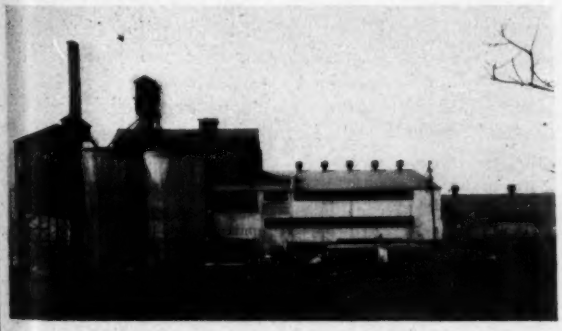
On March 31 of this year, Neville Island Glass Company, Inc., started manufacturing glass containers and it is generally agreed that Mr. Dugan has chosen an ideal site for his operation in locating in Pittsburgh.

When Walkerman D. Dugan, President of the Corporation, was investigating various plant sites in 1945, for his new glass making venture, he was attracted to the Neville Island location by an abundant fuel supply offered by the Pittsburgh Coke and Chemical Company, one of the major industries operating on the Island. Not only was there a sufficient supply of good fuel to support uninterrupted operations of a glass plant, but there was a splendid site consisting of approximately eight acres of level ground, excellent rail and highway facilities, and a rich glass consuming metropolitan market in the immediate area. The site of this newcomer to the glass industry is on Neville Island in the Ohio River, about ten miles below the "Golden Triangle" in Pittsburgh, Pennsylvania. Like a number of other progressive industries existing on the Island, it adopted the style of Neville Island in its name to properly identify its location.



A general view of the Neville Island Glass Company plant showing the factory, lehr and warehouse buildings.

In organizing Neville Island Glass Company, Inc., Mr. Dugan resolved that the plant would be unsurpassed in equipment and efficiency and engaged Frazier-Simplex, Inc., of Washington, Pennsylvania, as the engineers to design and supervise the construction of this modern glass container factory. Plans were drawn up and the construction was started in the summer of 1946. Despite the general shortages of all types of building materials and equipment and the many other construction difficulties prevailing at the time, the factory was brought from the blueprint stage to the making of glass containers in approximately nine months' time.

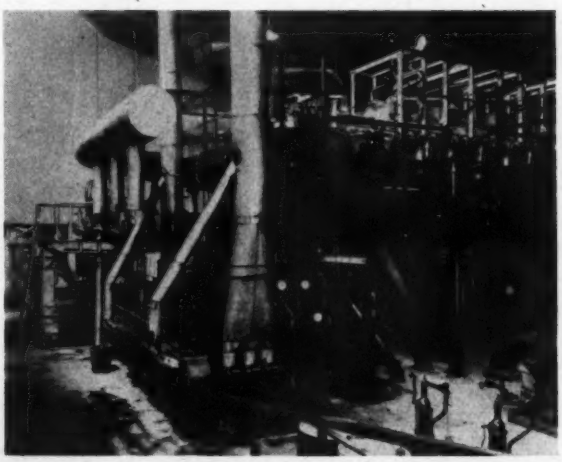


Railroad side of the factory buildings showing the twin reinforced concrete silos for batch storage and preparations.

The Neville Island Plant is of modern mill type, steel and concrete construction, and designed for the most efficient utilization of all floor space. All installations are located on the eight-acre plant site with a view to future expansion without impairing the utility or interrupting in any way the operation of present equipment. The main administrative offices are in a separate building and the plant superintendent's office is in the factory.

The basement of the factory building is at ground level and houses the machine shop, maintenance and refractory storage. The warehouse floor is at railroad car level and is equally accessible for rail or truck shipping. A section of the warehouse building is allocated to the compressor room and switch gear station and another section to provide modern washroom and locker facilities for the employees. A system of concrete ramps connect the warehouse and packing room floors, as well as providing tractor communications between the ground level, warehouse, and charging floors.

A mezzanine floor over the lehr room houses the wind system fans for both man and machine cooling, thus minimizing interference at the machine floor level. The lehr and furnace buildings are designed to take advantage of the optimum in natural ventilation and daylighting in order to assure maximum comfort and efficiency of operating personnel.



General view of one of the six complete shops showing Hartford feeder, 5-section I. S. forming machine, lehr loader, and annealing lehr. (Note wind system, catwalks, and absence of interference around machines to permit freedom of movement for adjustment and repair.)

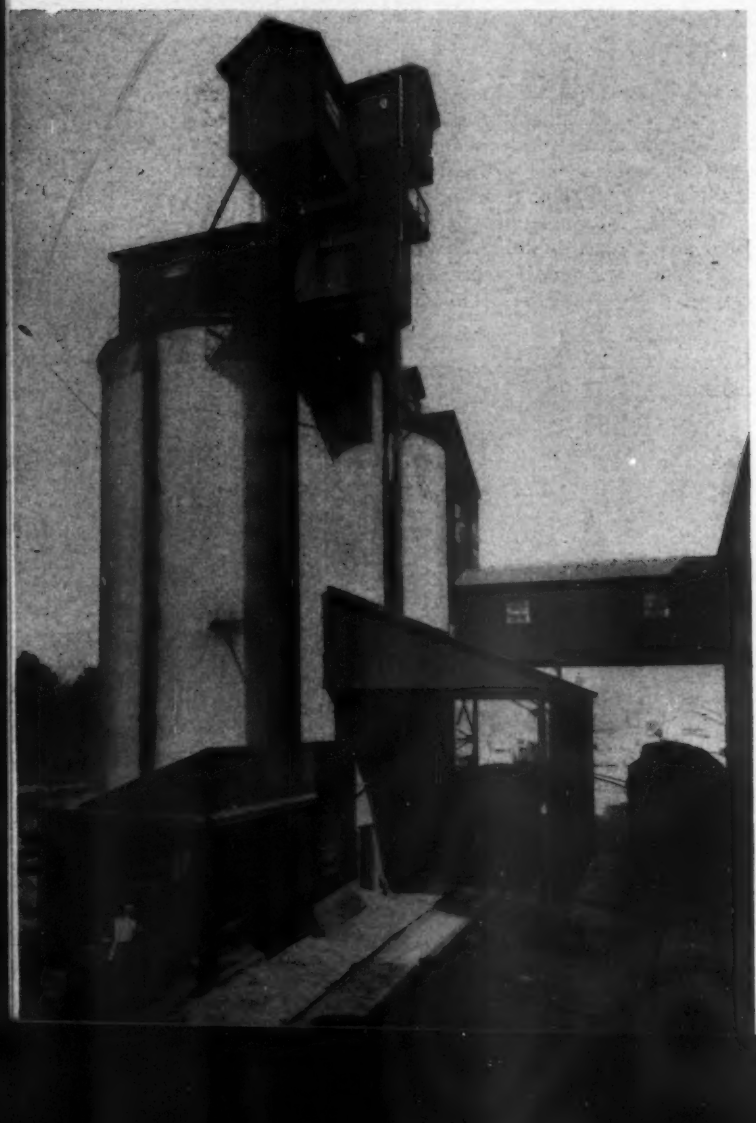
The factory buildings are equipped with Robertson ventilators, Robertson roofing material, and "Plasticlad" corrugated steel siding.

Accessibility to all vital points in the capital equipment, such as furnace and forming machines, is an outstanding feature of the metal-working end of the factory. A well designed system of inter-connecting catwalks under and above ports and around all feeders and machines simplify adjustments, maintenance, and repair work.

The furnace, designed and installed by Frazier-Simplex, is equipped with a Simplex Air Reversing Valve and the Simplex Blanket Batch Feeding System. This ingenious batch feeder charges a 12′ wide blanket of batch of shallow, uniform thickness into the furnace and is delivering a high degree of melting efficiency.

With this method of introducing the raw batch onto the surface of the melt, full advantage is taken of the hot surface glass beneath the batch to accelerate the melting operation. The batch is fed into the feeder hopper from containers carried on the overhead mono-rail system and flows by gravity onto a wide reciprocating plate. The plate gently forwards the batch through a wide covered charging slot onto a preliminary chamber where the batch is "fritted" or fused together before coming into the path of the fuel stream. This prevents dusting of the furnace atmosphere and assures melting

View of the batch plant showing the unloading and cullet elevators and cullet receiving hopper.



Two views of the well-lighted lehr room.

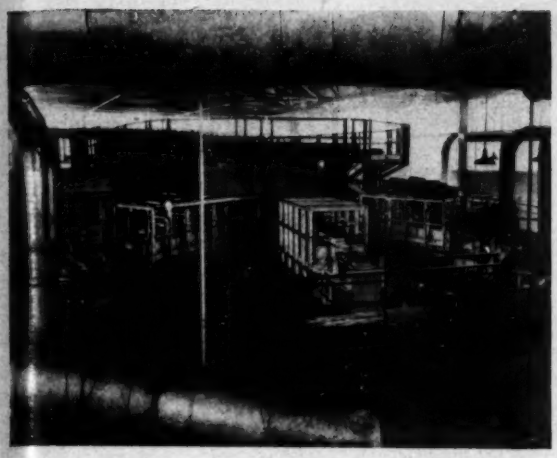
campaigns of maximum duration which is an important consideration in a plant having a single melting unit.

The plant is equipped with the latest type Hartford-Empire forming machines and feeders, which consist of six complete shops. All machines are of the five-section I. S. type with provisions for "62" process, double gob, and later installation of ten-section shops to process approximately 150 tons of glass containers daily.

This forming machine set-up provides Neville Island with a versatility for glass making unexcelled by any glass container plant of similar size to be found anywhere.

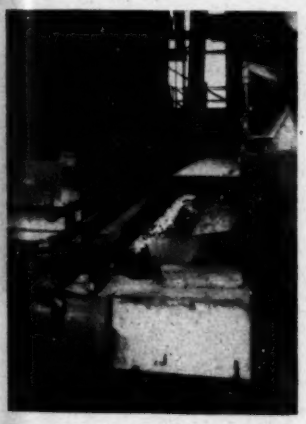
The batch plant stresses simplicity and dependability. All mechanical equipment is of proven design, and mechanization has not been carried to the point of diminishing returns as is sometimes the case with plants of limited glassmelting capacity.

The main structure consists of twin reinforced concrete silos which were installed by the unique slip form and continuous pouring method to provide maximum durability. The raw materials handling system provides for delivery by truck or rail and unloading from hopper bottom or box cars. A bucket elevator conveys the incoming materials from a track hopper to a motorized distributing head atop the silos whence they flow by gravity into the proper compartments. The silos have a storage capacity to provide two to three weeks' supply of all needed raw materials. Manually operated weigh



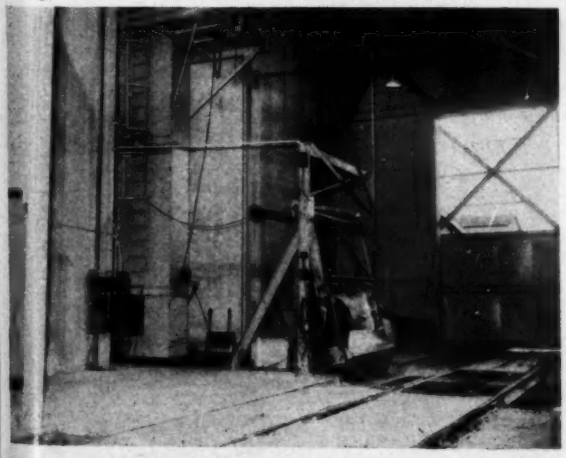
Working end view of Frazier-Simplex furnace showing catwalks and latest type Hartford-Empire forehearths and feeders.

hoppers are located beneath each material bin, where each ingredient is accurately measured and then deposited on a fully enclosed gathering belt. Each weigh hopper is equipped with Kron Print Weight Recording Scales. The gathered batch is conveyed to the mixed batch elevator, whence, it is fed to a Ransome glass batch mixer located in the mixer tower opposite the furnace charging floor.



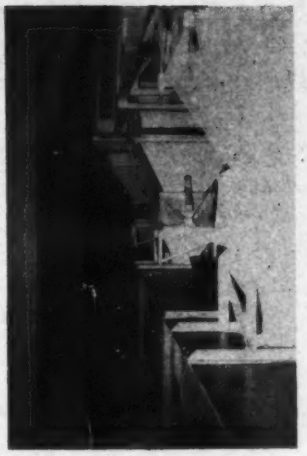
Close-up view of the Simplex batch feeder charging a 12 ft. wide blanket of batch into the furnace.

The batch mixer discharges directly into mono-rail containers located in the gallery beneath the mixer and are conveyed by an electric mule to feed position over the batch charger or to a storage position as required. The mono-rail system was installed by the Cleveland Tramrail Division, Cleveland Crane and Engineering Company, and designed to provide twelve hours' storage of batch requirements.



Track hopper, skip and power shovels for unloading raw materials.

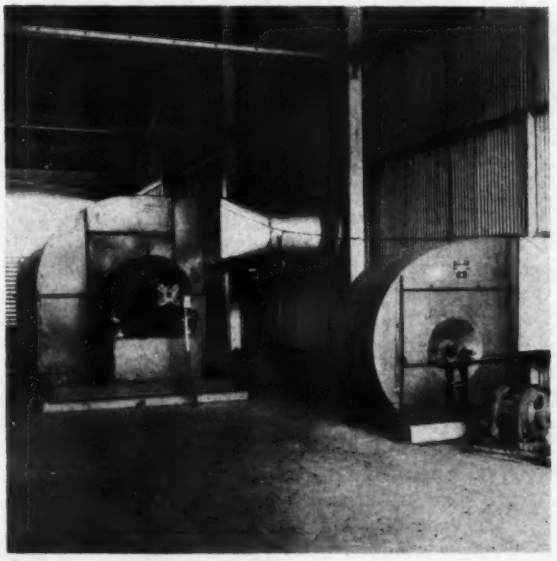
The batch plant has handling and storage facilities for both native and foreign cullet. These are received by truck or rail and deposited on an apron conveyor which conducts them to the cullet crusher. From there, they are elevated by a separate cullet elevator to a shuttle conveyor atop the silos and distributed into their proper compartments after passing over a magnetic separator to remove any tramp iron or foreign bodies which would endanger the quality of the glass.



Weigh hoppers and fully enclosed gathering belt located beneath batch storage bins.

The complete batch system was designed to assure accuracy of weighing and mixing and to minimize labor requirements. The unloading, gathering, and mixing operations are controlled from the gathering room floor. Simplicity and cleanliness of operation are the keynotes with an accurate check on quality control from raw materials to the finished product.

A modern and efficient control laboratory with all the latest apparatus and devices to insure a constantly uniform product of high quality is housed in a section of the warehouse building overlooking the packing room. Tests are made at fifteen minute intervals and records of the batch are kept from day to day. A modern analytical chemical laboratory has been provided for and will be installed as soon as equipment can be secured.



Man and machine cooling fans located on mezzanine floor overlooking furnaces.

A modern machine shop is installed at the ground

(*Continued on page* 594)

AN ELECTRICALLY HEATED GLASS TANK

The original of a paper which appeared in the Russian journal, *Glass and Ceramic Industry*.

F. S. Entelis tells in *Stekolnaya i Keramicheskaya Promyshlennost* (Glass and Ceramic Industry) 1947, No. 4, p. 8, the experiences with the first electrically heated glass furnace in Russia.

The furnace was erected between January 1945 and January 1946 as a part of the mullite plant in Erivan, Armenia. The electric energy in Erivan is obtained from hydroelectric power stations utilizing the mountain rivers

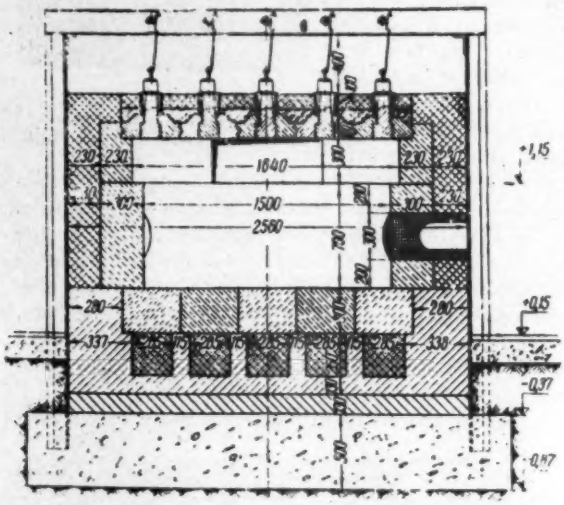


Fig. 1

of Caucasus. The furnace yields Fourcault window glass, the composition of which is not stated; neither is the batch composition given. The first glass sheet was produced on February 1, 1946, and the report is based on the first two months of operation.

The supply of batch to the tank and the final treatment of the glass sheet are mechanized. The tank consumes 6 to 8 metric tons of batch daily. This amount is filled every day into 8 containers provided at the bottom with a regulated feeder. Two containers are placed at the charging windows of the furnace on two cantilevers. The rest are fixed in a stand and are, in pairs, mechanically transported to the charging windows when the previous pair has been emptied. This exchange occurs every six hours.

The Furnace

The furnace is heated by alternating electric current passing through molten glass between steel electrodes; that is, the heat is evolved within the glass mass.

The furnace has the shape of a three-prong star, see Fig. 1 (vertical cross-section), 2 (plan) and 3 (elevation), on which all the measurements are in millimeters. The melting end consists of 3 branches forming with each other angles of 120°. Two of these branches are called *melting prongs;* they are each provided with a charging window and two ports and work in parallel. In them the batch is heated and chemically decomposed, and the silicate formation starts.

The silicate formation is accomplished in the triangle confined between the three prongs. This triangle received the name *tri-phase center.*

In the third prong the following regions can be differentiated: fining zone, cooling zone, Fourcault channel, and machine chamber with a "dry," heated "dead end."

The depth of the furnace is not identical in different zones as it determines the temperature of the glass, which must be adjusted to the physical and chemical changes intended. The fining zone is the shallowest part of the furnace (550 mm. = 21.6 in.) so as to reach the highest temperature and the most complete degassing of the glass.

A barrier (floating bridge) is placed in front of the Fourcault channel. Right and left of it recesses are made in the side wall for trapping the unmolten parts.

Except for the bottom of the Fourcault channel, the whole tank is constructed of mullite blocks. The crown of the tank, far from being a heat source as in the ordinary glass furnaces, constitutes an important path for the escape of heat. The surface of the glass in the tank is cooled by the crown and becomes covered with a very viscous crust which retards both melting and fining. To reduce the heat loss through the crown, the ceiling should be made flat and placed as near to the glass surface as possible, see Fig. 1. Shortage of suitable refractories did not permit the realization of this scheme, and the ceiling is arched. The whole furnace, and especially its crown, is heat insulated with the greatest care, but the insulation is not specified in the original paper.

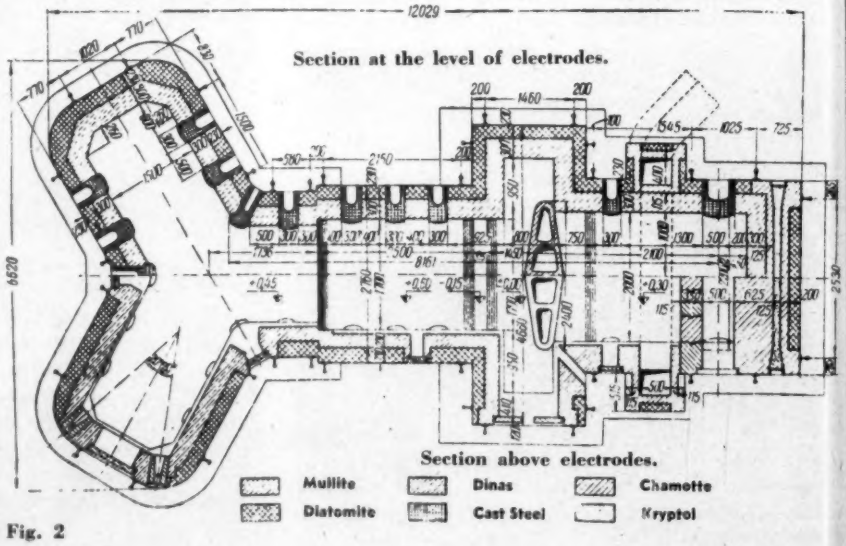


Fig. 2

The heating current is supplied through electrodes encased between the mullite blocks. The electrodes are of cast steel and weigh about 350 kg. (770 lb.) each. The surface in contact with glass is well finished and has a definite curvature. The opposite surface (toward the exterior of the furnace) of the electrodes is deeply indented. Into these recesses cold air is introduced at such a rate that the outgoing air has the temperature of about 70° C. (158° F.). This warm air is used for heating. The electrodes are connected with the cables by means of heavy copper bars.

The end of the furnace opposite to the charging end is heated indirectly. Its wall contains a slit filled with kryptol (powdered electrode carbon). When a 120 volt current is directed through the kryptol layer between two carbon electrodes, heat is evolved partly in the carbon particles and partly because of the numerous arcs plying between these particles.

The electric current supplied to the sub-station of the plant has the voltage of 6300-6900 volts. It is transformed in a 3-phase transformer of 1000 kilowatts power to 220 ± 11 or 127 ± 6 volts. The usual voltage is 127 ± 6 volts. The voltage supplied to every pair of electrodes in the three prongs and to every electrode in the 3-phase center can be varied within a range of 30 volts by seven 4.3 volt steps. This variation is carried out by the supervisor in charge of the panels of electrical and thermal instruments.

The expected relative expenditure of the furnace is as follows:

	Per Cent
Heat loss through the windows and insulation	28.5
Heat carried away by air blast	25.3
Heat spent on glass making	31.9
Heat capacity of the glass sheet	14.3
	100.0

As the heat carried away by the air blast from the electrodes is utilized, the total utilization of heat may be set equal to 71.5%.

The expected expenditure of energy per 1 kg. (2.2 lb.) of glass is 2.18 kilowatt hours or, when the heat in the air blast is subtracted, only 1.63 kwh. The power supplied to the tank was expected to be 810 kilowatts, but proved to be (in the second month of operation) 704 kilowatts. This power was spent as follows:

melting prongs	354 kilowatts
tri-phase center	132 "
fining zone	196 "
Fourcault channel	23 "

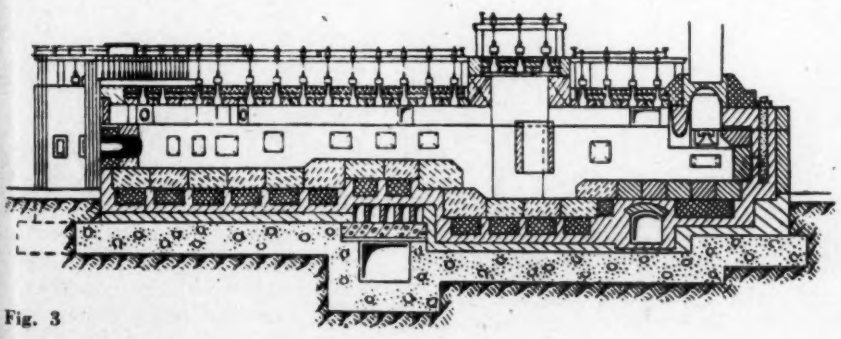


Fig. 3

Table I shows the concentration of heat in various parts of the furnace.

TABLE I.

CONCENTRATION OF HEAT IN VARIOUS PARTS OF THE FURNACE

Zone	Heat evolved in cal./hr. H	Surface area of glass in sq.m. A	Volume of the zone in cu.m. V	H/A	H/V
Melting prongs	304500	5.85	4.09	52000	74500
Tri-phase center	113500	3.00	2.10	37800	54000
Fining zone	167700	5.19	3.04	32350	55200
Fourcault channel	19800	3.20	2.72	6200	7300
	605500	17.24	11.95	35100	50700

A comparison of the costs of electric and usual melting processes is instructive. In an ordinary glass furnace producing 8-9 metric tons of glass per day, about 6000 calories are spent per kilogram of glass. That amount of producer gas which gives 6000 calories on combustion cost 18 kopekes before the war if peat was the fuel, 10 kopekes if coal was used, and 11 kopekes if oil residues were gasified; all prices being valid for Erivan. Since 1 kwh. in Erivan is priced at 2.5 kopekes, the expenditure on electric heating is $1.63 \times 2.5 = 4.1$ kopekes per kg. of glass.

Electric melting has also other advantages: 1) The electric tank is smaller than the usual tank having the same productivity. This is shown in Table II.

TABLE II.

COMPARISON OF GAS HEATED AND ELECTRICALLY HEATED FURNACES

	Gas	Electric
Furnace area	31 x 13 meters	6.2 x 12 meters
Height	13.5 m.	8.0 m.
Material required:		
Red brick (pieces)	180000	35000
Checker brick	630 tons	45 tons
Dinas brick	30 "	8 "
Shaped chamotte	120 "	11 "
Shaped dinas	35 "	10 "
Mullite	12 "	53 "
Metal	50 "	7 "
Steel electrodes	—	18 "

2) The erection of a producer gas works, a gas cleaning station, a checker work, and a tall chimney stalk is avoided. 3) No space under the furnace is required. This is important when the presence of water near ground level makes deep basements impracticable. 4) The "life time" of Fourcault machines is, when attached to an electric furnace, longer than when the glass is molten with an open flame. 5) The glass obtained in the electric furnace does not show striae which

(*Continued on page* 602)

GLASS PROCESSING IN THE MANUFACTURE OF NEON SIGNS

By M. G. HAWKINS

Processing neon tubing is a specialty of Electrical Products Consolidated, Seattle, Washington, manufacturers of custom built neon signs. Methods and equipment have been developed by the company to the extent that the largest sign can be completed in four days from order to installation.

The Kirsten "Hi-Tensity" tube, a hot cathode fluorescent tubing, developed by the company, is from twenty to thirty-five times as brilliant as conventional neon. "Nonex," a hard heat resisting glass similar to Pyrex but less difficult to manipulate and somewhat less brittle, is processed for the Hi-Tensity tubes. Lead glass, which softens sufficiently for bending at 350 deg. F., is used for conventional neon tubing. Designated by the OD, the ID of the tubing is most important to the efficiency of the tube and its apparent brilliancy. It is obtained under the trade name "G 1" from the Corning Glass Works, and is usually in 4-foot lengths.

Routine glass blowing methods are employed to maintain walls of uniform thickness and keep the diameter the same while forming the tubing to design. Hand torch, ribbon and cross fire burners provide the flames for the glass working. Each burner is controlled at a general temperature governed by tube diameter and the type and color of glass used. The burners are operated on city gas, mixed with air through a gas booster to give greater heat to the flame. The air pressure is 5 to 6 times that of the gas, with volume at low pressure the controlling factor. When the flame is properly adjusted there is no chemical reaction to the glass; however, a slight degree of oxidation occurs where there is too much gas. Excessive heat or too long wait before welding fluorescent tubing will cause injury to fluorescent salts lining the tubes.

Essential to the bending of the tube is the detailed asbestos template. It is drawn in the reverse so that the hot tubing can be matched directly to the non-inflammable pattern, and that the double-backs, connections, and so on, will appear at the back of the finished tube.

Selecting the proper size and type of glass, according to the diagram of the design, the glass worker measures the cold tube against the template, estimating how much can be made from the 4-foot length, allowing space for bends, double-backs, and at least 6 inches on each end as a working handle of the tube. He then proceeds with the glass blowing technique, shaping the tube to design when it has reached "spaghetti softness," by repeatedly heating, bending and matching it to the template. The glass is kept in motion, and closely watched to avoid strains, and to produce a strong clean bend. Extreme care is taken in forming a double-back to avoid it appearing thicker than the rest of the design. Supports are used while welding large and unwieldy units.

Upon final assurance of accuracy to design, a small bore glass, from 4 to 6 inches long, is welded to the rear of the unit at right angles to the glass. If mercury is to be introduced in the tube, a small trap is made a part of this tubulation by the glass worker. After sealing on the electrodes, the tubulation is used to attach the formed unit to the pumping system.

While the mechanical pump is operating on the tube, a mercury aspirator is also working to create an even higher degree of vacuum. "Hysteresis," or radio frequency employed in addition to the usual pumping methods, releases occluded gases from the electrodes, which are then drawn off by the pump. When the desired degree of vacuum is shown, the tube is tested with a Tesla coil for any remaining gas.

If the tests are satisfactory, the pumping is stopped and a small amount of rare gas is fed under definite pressure (usually about one-tenth of an atmosphere) into the tube. The tube is now sealed-off behind the mercury trap, and tested on the "Epcon" table for leakage. If there is none, the tube is burned-in for a period of time as a further test. If it is a neon or helium tube, it is then complete. But if an argon-krypton tube, a small amount of mercury is dumped into the mercury trap, which is then sealed-off.

Epcon processing tables in foreground with portable racks for glass tubing in the immediate background. Partial view of glass bending department is left.

Action of the mercury vapor on the carrying gas (neon, argon, helium, krypton and xenon) used, and the chemical combination of fluorescent salts lining the tube provide color variations. For instance, in the non-fluorescent tubing, orange or neon red is produced with clear glass and neon; blue with clear glass, mercury vapor and various argon mix-

tures. Green is produced with Noviol glass (a special type of canary yellow glass), mercury vapor and argon mixtures. In the fluorescent tubing the variation is achieved through the fluorescent coating itself. Thus rose is produced with fluorescent tubing and neon gas; white with fluorescent tubing, mercury vapor and argon mixtures.

With sixteen color variations possible in the luminescent tubing, only a stationary or an off-and-on effect can be created with fluorescent tubing. The colors which can be welded together in one length are canary, blue and white; or, tangerine and rose. Non-fluorescent tubing is necessary where animation is planned, and each color desired must have a complete outline of tubing.

Over-all view of final assembly department where finished glass is mounted to completed cabinets.

As the neon tubing is processed, the necessary metal cabinet is built in the sheet metal department. Because of the high voltage required by the luminous tubes, every safety precaution is incorporated in its construction. Using paint spraying methods, the entire cabinet is lacquered a background color of the lightest color used in the design. Allowing approximately four hours' drying, the outline of the reading matter, borders, etc., is transferred to the face by pounce. Masking mud protects the area outlined by the dust pattern from further spray coats. This protection is given a desired color with each color addition. Striping is done by hand.

The finished cabinet is fitted with 1¾-in. McMahon glass supports. These snap hooks are spaced at 12-in. intervals and follow the outline for the advertising illumination. Two hooks are placed as near as possible to each electrode to absorb the shock at these points. Electrode insulation is provided by high tension 4-in. porcelain bushings.

When both units are completed, the glass is mounted, allowing an average of 65 feet of neon tubing per transformer, or 85 feet for fluorescent tubing. Wherever any "break" in the continuity of the tubing occurs, through which no light must pass as in forming letters or words, the tubing is painted the color of its background to form an opaque or black-out separation.

In the case of a large display, after an operational test, the tubing is dismounted and taped on special racks for delivery and installation.

Among the features of the glass department are the Electric Products Consolidated designed and manufactured high voltage processing tables. These 12-foot tables are fully insulated by a horizontal layer of 4-foot glass tubes, spaced approximately 6 inches apart. Another invention, manufactured by the company, is a radio frequency oven which evacuates air and draws out all impurities in processing cold cathode lighting tubes.

In this process, eight 10-foot tubes are slid into the oven on a rack grooved to fit each tube. Each tube is sealed with a mercury trap to the manifold, and the pump is started with the gauge set at a certain vacuum reading. The dials are closely watched throughout the processing. Upon conclusion of the baking period, the rack of tubes is withdrawn and each tube is gauged tested as to readiness for the introduction of the rare gases. After a cooling period, the tubes are gassed, sealed and then hung for ageing on a specially constructed circular rack which holds them in perpendicular position.

PRODUCTION RESUMED AT BALL BROTHERS HILLSBORO PLANT

R. C. Myers has announced that glass production, which has been discontinued since last May 16 for extensive repairs, remodeling and modernization, has been resumed at Ball Brothers' Hillsboro factory.

Modernization of the Hillsboro installation, Meyers said, increased capacity 25 per cent and made it possible for operations to be placed on a continuous basis for the first time in the plant's history. This will result in an employment increase of about 15 per cent.

During the time the factory was down, its glass melting furnace was razed and a new one, larger and of the most modern design, was built in its place. Installation of this new furnace and other improvements boosted capacity for the manufacture of pharmaceutical glassware, beverage containers and juice extract bottles from 135 to 160 tons daily.

The new furnace was designed to burn oil, a switch from the use of producer gas. The conversion made it possible for the plant to gain two full production days every two weeks. Heretofore, the factory could operate only twelve days consecutively and then it would be down for two days.

To properly handle the increased output, two new air-cooling systems were installed, one for the glass forming machines and a second for the bottle moulds. In addition to these improvements, the Packing Department was remodeled and rearranged to accommodate the increased production. Here, the installation of several new carton pre-sealing machines modernized the department and increased its efficiency.

INVENTIONS AND INVENTORS

A Summary of Recently Issued Patents of Interest to the Glass Industry

Glass Compositions

Vitreous Enamel Opacifier. Patent No. 2,427,682. This patent relates to an opacifying material for use in vitreous or porcelain enamel. It is the invention of Anthony J. Lubertine of Baltimore, Md., who assigned it to Pemco Corporation.

This opacifier is a reaction product prepared by heat treating a mixture containing an antimony compound, material containing titanium and zirconium, available oxygen and a fluorine-containing agent. The ingredients are ground to pass a one hundred mesh sieve which may be used in accordance with the following table:

	Specific Example Having Ingredients, in percentage by weight	Broad Range of Ingredients, in percentage by weight	Preferred Range of Ingredients, in percentage by weight
Sb_2O_3	30	20-34	27-34
KNO_3	9.5	6-14	8-10
$NH_4F.HF$	9.5	6-16	8-12
TiO_2	22	14-26	20-24
$Ca.(OH)_2$	29	20-36	26-31

This results in a great increase in opacity.

The patent contains 22 claims of which claim one may be taken as an example. Claim 1. A vitreous enamel opacifying material comprising the calcined reaction product of a mixture of 20 per cent to 34 per cent of an antimony oxide, an oxidizing agent in an amount to oxidize the antimony oxide and to maintain an oxidizing atmosphere during calcining, 14 to 26 per cent of an oxide selected from the group consisting of titanium and zirconium oxides, together with the reaction product in minute particle size of an admixture of 6 per cent to 16 per cent of an ammonium fluoride and 20 per cent to 36 per cent by weight of calcium hydroxide.

The following references are of record in the file of this patent: United States Patents: 2,189,148, McIntyre et al., Mar. 13, 1939; 2,199,794, Harshaw et al., May 7, 1940; and 2,200,170, Harshaw et al., May 7, 1940. Foreign Patents: 484,562, Great Britain, May 6, 1938.

Miscellaneous

General Electric Bulb machine. Fig. 1. Patent No. 2,427,712. This patent shows a machine for forming miniature lamp bulbs. It is the invention of Adrien F. Casler and John J. Salo who assigned it to General Electric Company.

As shown in the drawing, a bulb is fed from a chute 73 to a holder at station A-1 carried by a turret A. The bulb is then indexed through idle stations A2 to A5 and then to station A6 where it is centered in the holder 20 by a bar 107. At station A7 the neck to be severed from the bulb is heated by a burner 110. The end of the bulb is severed at station A8 by a cold wheel on the crack-off mechanism 112. At stations A9 and A10 the cut edge of the bulb is glazed by burners 152 and 153. The bulb then goes to idle station A-11 to station A-12 where it is again centered by an aligning bar 158. At station A-13 the bulb is released from the holder 20 and picked up by a transfer wheel T.

The transfer wheel delivers the bulb to a chuck on a turret B which carries the bulb through several idle stations to station B-5 where it is accurately positioned by a mechanism 300. The bulb then passes to station B-15 being heated on the way by burners 323. At station B-16 a tipping mechanism 325 forms a tip on the bulb which is also annealed at this station by a gas burner. The bulb is further annealed and carried to a discharge station B-19 where it is delivered to a conveyor 362 along which it is carried by a stream of air.

All details of construction may be had from the 14 sheets of drawings of this patent.

The following references are of record in the file of this patent: United States Patents: 568,142, Lean et al., Sept. 22, 1896; 1,011,523, Swan, Dec. 12, 1911; 1,132,277, Marshall, Mar. 16, 1915; 1,251,541, Knight, Jan. 1, 1918; 1,508,358, Brown, Sept. 9, 1924; 1,655,141, Fagan et al., Jan. 3, 1928; 1,756,843, Wheeler, Apr. 29, 1930; 1,864,023, Ledig, June 21, 1932; 1,869,533, Wetmore, Aug. 2, 1932; 1,984,031, Purdy et al., Dec. 11, 1934; 2,004,492, McNamara et al., June 11, 1935; 2,098,030, Donovan et al., Nov. 2, 1937; 2,134,955, Risser, Nov. 1, 1938; 2,146,572, Hahn et al., Feb. 7, 1939; 1,164,285, Schutz, June 27, 1939; 2,168,419, Paterson, Aug. 8, 1939; 2.206,267, Schutz et al., July 2, 1940; and 2,207,179, Schreber, July 9, 1940.

Glass Tube Heating Apparatus. Fig. 2. Patent No. 2,427,722.

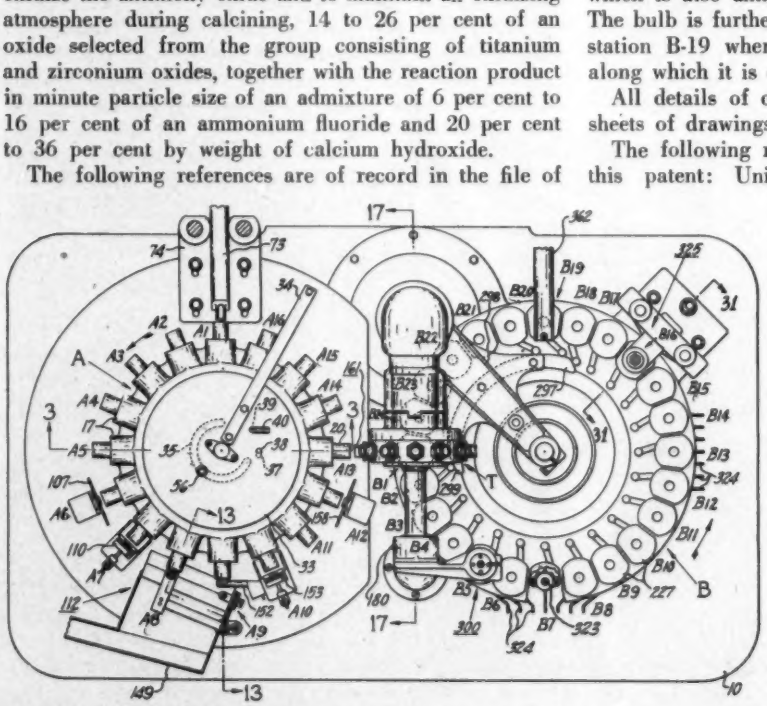


Fig. 1. General Electric Bulb Machine.

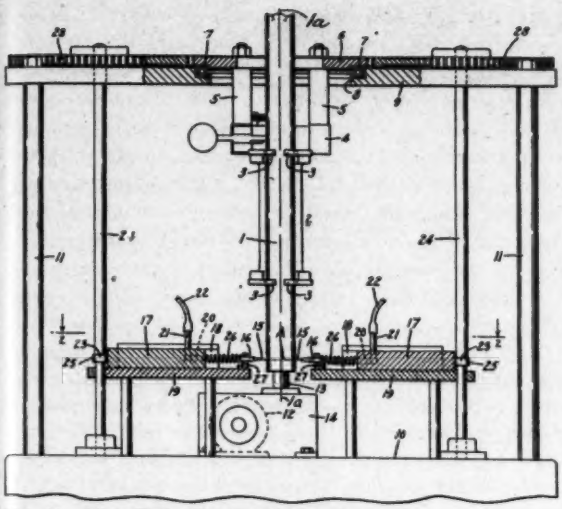


Fig. 2. Glass Tube Heating Apparatus.

This patent shows a gas fired heating device for heating a narrow zone around a tube of noncircular cross section. It is the invention of Alfred Greiner of Cleveland Heights, Ohio, who assigned it to General Electric Company.

It is quite simple to heat a circular tube for cutting or necking by revolving the tube or the burners. If the tube is noncircular, additional means must be provided to heat the circumference of the tube uniformally. This patent provides means for moving the burners toward and from the tube so that the burners are at a constant distance from the tube at all times.

Fig. 2 shows an elevation, partly in section, through the machine. The tube 1 of elliptical cross-section, is inserted in a rotary holder 2 having spring pressed jaws 3 which grasp the tube. These jaws are mounted on posts 5 depending from a gear 6 supported by ball bearings 7. The bearings are supported by a plate 9 on the upper end of posts 11 rising from a table 10. The holder 2 is rotated by a motor 12 which drives a vertical shaft 13 through a speed reducer 14. The upper end of this shaft carries a gear (not shown) in mesh with the gear 6.

As the tube is rotated, it is heated along the line A by flame from burners 16 which are moved horizontally toward and from the tube. This movement is provided by mounting the burners on slides 17 which move in ways 18. Fuel is supplied to the burners by rubber tubes 22. The burners are moved toward the tube by cams 23 and away from the burners by springs 26. The cams 23 are mounted on shafts 24 which are driven in synchronism with the tube by gears 28 which mesh with the gear 6.

It is obvious that the shape of the cams 23 must correspond with the shape of the tube to be heated and that varying the shape of the cams, tubes of any cross-section may be uniformally heated all the way around.

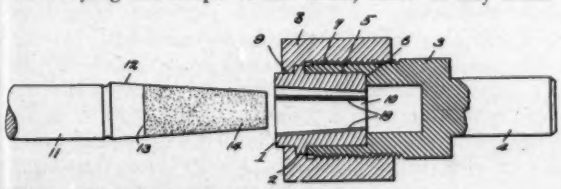


Fig. 3. Method of Grinding Stoppers.

The following references are of record in the file of this patent: United States Patents: 1,314,212, Quimby et al., Aug. 26, 1919 and 2,371,881, Dichter, Mar. 20, 1945. Foreign Patents: 104,962, Great Britain, Mar. 29, 1917.

Method of Grinding Stoppers. Fig. 3. Patent No. 2,427,849.

This is an invention of Charles B. Garwood who assigned it to Carr-Lowery Glass Company. Heretofore it has been customary to grind each stopper to fit the particular bottle that it was to close. This made it necessary to fasten each stopper to its bottle. This was not only expensive but if a stopper became unfastened, it was difficult to find the bottle to which it was fitted. This patent provides a method by which any stopper will fit any bottle.

It is common practice to grind the inner surface of bottle necks to a standard taper but it has been necessary to grind each stopper to fit its particular bottle. This invention depends upon the use of a new stopper grinding die which is made as shown in Fig. 3. The die comprises a sleeve 1 of soft metal such as copper, having an "angular" flange 2. This is held in a chuck having a shank 4. The taper of the bore 10 in the sleeve 1 is approximately that of the stopper to be ground. To bring this bore to the exact taper required, a hard metal mandrel 11 has an end 12 shaped to the exact taper required in the stopper. This is also the exact shape of the tool used in grinding the opening in the bottle neck. This tapered end is then coated with petroleum jelly or some such material as indicated at 13, which is then impregnated with diamond particles as shown at 14. The mandrel 11 is then inserted into the sleeve 1 and hammered so that the diamond particles become imbedded in the opening in the sleeve and the taper of the opening is made to correspond exactly with that in the bottle. This die is then used to grind the stopper which is preferably done under water. Grooves 19 are provided to carry off the dust during the grinding operation. If the die formed in the sleeve 1 gets out of shape due to wear, it can be reshaped by driving the mandrel 11 into it again in the same way as described.

The following references are of record in the file of this patent: United States Patents: 704,428, Allen, July 8, 1902; 1,243,496, Eimer, Oct. 16, 1917; 1,324,126, Mathy, Dec. 9, 1919; 1,915,016, Diffenderffer, June 20, 1933; 190,115, Babcock et al., May 1, 1877; 341,867, Andrews, May 18, 1886; 1,072,692, Bowers, Sept. 9, 1913; 1,099,984, Kirsten, June 16, 1914; and 1,870,723, Friedman, Aug. 9, 1932.

Sealing wires into Glass. Fig. 4. Patent No. 2,428,059.

This is a British invention by Henry Wolfson and Stanley C. Shepard of London, England. They assigned it to International Standard Electric Corporation of New York. A corresponding application has been filed in Great Britain. The patent relates to sealing wires into glass tubes of small cross-section, particularly tubes known as thermistors. These require an air tight chamber usually made from glass tubing.

Fig. 4 shows a machine for sealing and moulding thermistors according to the method of this patent. Lead wires 1, 2, 3, and 4 pass through a glass bead 5. The wires 2 and 3 are connected to a heater coil. The bead 5 and the four wires held thereby, are held by a

jig 13 supported by a rod 14 carried by a rotating platform 15. A bulb 9 is held by jaws 16 by which it may be moved vertically as desired. A gas-oxygen flame 17 heats the bottom edge of the bulb as it rotates so that the hot glass flows down and closes the end of the bulb. The soft end is pushed against the hard surface 18 to flatten the seal. After the wires are sealed in this way, the tube is evacuated or filled with gas in the usual way.

The following references are of record in the file of this patent: United States Patents: 1,372,294, Karabin et al., Mar. 22, 1921; 1,965,408, Eden et al., July 3, 1934; 2,235,515, Carpenter, Mar. 18, 1941; 2,107,254, Horn, Feb. 1, 1938; 2,174,375, Beggs, Sept. 26, 1939; 42,931, Demuth, May 31, 1864; and 2,153,404, White et al., Apr. 4, 1939.

Method of washing glassware. Patent No. 2,428,187. This patent relates to a method of washing glassware by which the attack on the glass surface by caustic soda solutions is greatly reduced. It is the invention of Walter F. Wegst and Perle N. Burkard who assigned it to Wyandotte Chemicals Corporation. A somewhat similar patent No. 2,419,805 also assigned to Wyandotte, was abstracted in GLASS INDUSTRY for June, page 305.

Washing solutions of relatively alkaline strength are generally employed for washing reuse containers such as milk bottles. Sodium hydroxide is usually included in such washing compounds. The alkali attacks the glass surface, spoiling the looks of the bottle. This is called "scuffing" which describes the appearance resulting from the action of the alkali on the mechanical scratching and wear on the glass surface. This effect is particularly apparent in fused color labels. It also reduces the strength of the bottle.

This invention provides for the addition of an organic compound to the usual washing solution so that glass attack is prevented without reducing the cleansing effect of the solution. It has been found that the addition of small amounts of tannin or related compounds, act to prevent attack on the glass. The following table shows the effect of various addition agents in accordance with this patent, to NaOH-tannin mixtures:

Solute Composition, Per cent			Wt. Loss,	Condition of Bottles	
NaOH	Tannin[1]	Other	Grams	Wet	Dry
86.4	4.0 QB	9.6 Na_2CO_3	0.114	Clear, No Scale	Excellent.
86.4	4.0 QB	9.6 Na_3PO_4	2.000	Heavy Scale	Good; Slight Etching.
86.4	4.0 QB	9.6 $Na_2SiO_3.5H_2O$	1.311	Heavy Sediment	Excellent.
86.4	4.0 PG	9.6 Na_2CO_3	0.095	Slight Precipitate	Fair. Cloudy; Etched.
86.4	4.0 PG	9.6 Na_3PO_4	2.057	Heavy Scale	Poor. Cloudy; Etched.
86.4	4.0 PG	9.6 $Na_2SiO_3.5H_2O$	0.750	Moderate Sediment	Do.
92.0	4.0 QB	4.0 $Na_4P_2O_7$	1.010	Heavy Scale	Good.
92.0	4.0 QB	4.0 $Na_6P_4O_{13}$ (Sodium Tetraphosphate)	1.812	do	Do.

[1]QB—Quebracho, Powdered; PG—Pyrogallol.

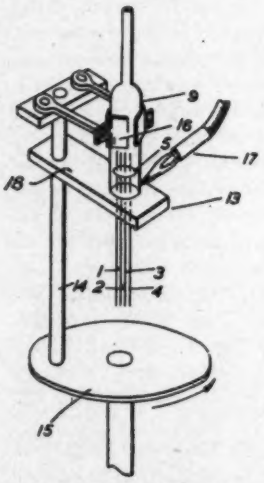


Fig. 4. Sealing Wires into Glass.

Strange as it may seem, ordinary tests also produced beneficial results. The suggested additative materials include tannic acid, gallic acid, pyrogallic acid and naturally occurring tannins.

The following references are of record in the file of this patent: United States Patents: 1,628,163, Lillejord, May 10, 1927; 2,241,948, Cooper, May 13, 1941; 2,248,656, Bird, July 8, 1941; 2,297,670, Schroeder et al., Sept. 29, 1942; and 2,359,943, Hill, Oct. 10, 1944. Other References: Chemical Formulary, Bennett, volume 4 (1939), page 507.

Glass Wool Pipe Covering. Fig. 5. Patent No. 2,428,653. This invention relates particularly to an insulating pipe covering, although it may be used for other similar purposes. It is the invention of Howard W. Collins, who assigned it to Owens-Corning Fiberglas Corporation. This material has a hard shell-like surface and the interior is a fibrous mass of greater resiliency.

In Fig. 5, the upper drawing shows an end view of the apparatus and the lower part, a section on the line 2—2. A bat of fibrous material is wound on a mandrel 10 to form a package 11 of greater outside diameter than is desired in the finished product. The package is then heated so that the outside of it is fused to form a compact shell. This heating is done in a chamber 15 containing a pair of power driven rolls 16 which support and rotate the mandrel 10. The rolls are mounted on shafts 17 which are driven by a motor 18. This compacts the package 11, reduces its diameter and hardens the surface. Flanges are provided to limit the movement of the mandrel 10 toward the rolls 16, thereby determining the minimum diameter of the product. Burners 26 heat the interior of the chamber 15 and additional burners 30 may be used to heat the rolls 16 to produce a hard surface on the package 11. Air is circulated through the chamber 15 through a circuit 27 connected with a blower 28. Good results can be obtained with a temperature of from 1100 to 1300° F. in the chamber. The bat may be wound on the mandrel 10 by hand or by the machine shown in Patent No. 2,206,059 to Slayter.

The bat before compressing is from 2 to 3 times the diameter of the finished product in some cases. Successive rolls are pushed onto the mandrel endwise, thus pushing the finished product off the other end. Two modified forms of the invention are shown.

The following references are of record in the file of this patent: United States Patents: 1,775,965, Middendorf, Sept. 16, 1930; 2,206,059, Slayter, July 2, 1940; 2,305,516, Coss et al., Dec. 15, 1942; 1,439,698, Erdle, Dec. 26, 1922; 480,592, Kittel, Aug. 9, 1892; 1,940,975,

(*Continued on page* 598)

Research Digest

Impact Marks on Glass

When two clean glass surfaces meet in impact, one or both may be marked at the point of impact, and the mark may be of two types. The first type is the conical, or conchoidal crack, while the second is a surface mark. This surface mark is a region of greyness, or lack of polish, and may appear to the eye as a collection of fine scratches, but it is actually a pattern of small, crushed flaws. If a conical crack is caused, the mark is generally entirely within the boundary of the crack and, therefore, within the area of contact of the two glasses, but a slight impact which does not cause a crack may cause a surface mark, while a very light impact may cause a mark which can only be seen either with oblique illumination or under the microscope. The flaws are due to local crushing or tearing of the surfaces, and then distribution, size and form are closely reproduced on both members subject to the impact.

In the August-October 1946 issues of the *Journal of the Society of Glass Technology*, J. G. Holmes describes a series of experiments undertaken to determine the nature of these surface marks. Experiments with solid soda-lime-silica glass spheres of 4 in. diameter with good ground and polished surfaces showed that they were not marked when brought into mutual impact or impacted with ground and polished plate glass or with a polished steel ball of 2 in. diameter. If the impact was heavy, a conical crack was formed, but there was no sign of any pattern of surface flaws. When the glass sphere was impacted with a fire-polished glass surface, or with any glass surface other than a ground and polished specimen, identical patterns of spots were produced on both glasses, and it seemed that the mark on the glass sphere was a reproduction of the flaws caused by the surface of the other member of the impact, the surface of the sphere contributing nothing. This identity of pattern enabled the glass sphere to be used in experiments more carefully controlled, the polished spherical shape being convenient for microscope examination. The glass sphere was useful as a hammer and had the advantage that it did not shatter under a heavy impact. Various glass shapes and surfaces were, therefore, impacted in this manner.

The conclusion reached as a result of these experiments is that impact between unpolished glass surfaces is likely to cause a breakdown of the surface, even though there is no conical fracture and, therefore, no crack is visible. This effect can occur when freshly broken surfaces are impacted and is therefore, not due to a "skin" on the surface glass, but it does not occur with good rouge-polished surfaces. The mark is probably associated with very small irregularities in the surface of the glass. These may be minute deviations from the perfect plane, or small irregularities in elastic properties, either of which would cause local concentrations of stress to occur. There may be present submicroscopic flaws which develop under the stresses produced during instantaneous mechanical contact and separation. The result of an impact is to produce flaws in the surface over part of the area of contact and, therefore, to weaken the glass, although no visible crack may have occurred.

Surface Tensions of Some Optical Glasses

Freedom from bubbles (seeds) is desirable for all optical elements, and for some elements, such as reticles, bubble-free glass is absolutely essential to the satisfactory performance of the element. Since bubbles have a glass-gas interface, it seems reasonable to suppose that the surface tension of the glass has a bearing on the stability of the bubble although it is believed that the exact effect of surface tension on the elimination of seeds has not been completely explained.

Bubbles in molten glass may be eliminated either by rising to the surface and being expelled or by absorption as the glass is cooled. The absorption of a bubble in a cooling glass is facilitated by several mechanisms which at constant volume would lower the gas pressure inside the bubble. Among these mechanisms are (*a*) normal lowering of gas pressure with decrease in temperature, (*b*) lowering of pressure caused by condensation of certain constituents, such as volatilized alkali and lead oxide, (*c*) absorption of gases, such as CO_2 and SO_2 by the condensed alkali, and (*d*) normal increase in solubility of gases in glass as the temperature is lowered. Since the surface tension of the glass acts to decrease the size of the bubble, the volume becomes smaller as the opposing gas pressure decreases. The pressure on a bubble, due to surface tension, is given by formula (1).

$$2\sigma/r \qquad (1)$$

σ = surface tension.
r = radius bubble.

Therefore, as the bubble contracts, the pressure due to surface tension increases until it is balanced by the gas pressure, which also increases as the bubble shrinks. This brings into play the increase in gas solubility normally associated with increasing pressure.

The net effect is that bubbles below a certain critical size are reabsorbed as the glass is cooled, a phenomenon which has been noted by practical glassmakers when taking samples. The hot sample may show many small seeds which disappear upon cooling; thus, in the reabsorption of small seeds, high surface tension is a favorable factor when it is accompanied by an increased gas solubility as the glass is cooled.

For the elimination of bubbles by their rise to the surface, low surface tension would seem to be advantageous because, other factors being equal and for a given amount of gas in a bubble, the glass with the lower surface tension will have the larger bubble. This effect is important since, according to Stokes' law, the rate of rise varies as the square of the radius of the bubble. The influence of viscosity on the elimination of bubbles is not included here because this property, in contrast with surface tension, changes markedly with temperature and thus may be controlled almost at will.

(*Continued on page* 603)

NEW GLASS PLANT ENGINEERING DEPARTMENT AT H-E

Announcement of a new Glass Plant Engineering Department at Hartford-Empire Company has been made by its President, S. F. Wollmar.

Hartford-Empire's new service will embrace new plant construction from initial design and layout to actual starting of production and will stress work in existing plants on the reduction of fire and other hazards, improvement of working conditions, fuel economies and general increases in production efficiency.

A group of experienced men has been assembled to head the new department's various activities. Morton Cressy, who recently joined Hartford-Empire after many years with American Cyanamid Company as director of similar plant engineering work, is Manager of the department. Associated with him are men well known to the glass industry, such as Charles F. Ryan, Aaron K. Lyle, W. W. Dolliver, Charles H. Wise and Lucius S. Bushnell.

Mr. Ryan, who will act as Manager of Sales and be in charge of customer relations of the Glass Plant Engineering Department, has been head of Hartford-Empire's Furnace Engineering Department, activities of which have been absorbed by the new group. He joined Hartford-Empire in 1932, after having been general superintendent of Thatcher Manufacturing Company.

Aaron K. Lyle, Chief Chemical Engineer in the new organization, has been chief chemist of Hartford-Empire, rising to that post since going there in 1938, after a career as chemist with Hazel-Atlas Glass Company and Bailey & Sharp. A trustee of the American Ceramic Society, he was chairman of the Society's Glass Division in 1941.

Mr. Dolliver, who is Chief Engineer and Construction Supervisor was in the building and construction business for 15 years before joining Hartford-Empire in 1933, first as an engineer in the Furnace Engineering Department and more recently as chief of planning for equipment installations and consultant on glass plant modernization.

Mr. Wise started at Hartford-Empire in 1932 as a draftsman and in 1939 became active in construction work, with special attention to furnaces. Previously he was with U. S. Rubber Company and Pratt & Whitney Division of Niles-Bement-Pond. He is now Chief Designer of the Glass Plant Engineering Department.

Mr. Bushnell, Project Engineer, was with the Bethlehem Steel Company on steel design work for three years, and in the construction business for seven years prior to taking up his work with Hartford-Empire in 1937 as a structural steel designer.

A more recent member of the Hartford-Empire staff, J. P. Vollrath, is Chief Estimator of the department and will be in charge of automatic controls. He went to Hartford-Empire last April, after 25 years with the Brown Instrument Company as an applications engineer to the steel and ceramic industries, with most of his work having been on the improvement of process controls.

In addition to his domestic experience with American Cyanamid, Mr. Cressy is the author of a report now being followed in the industrialization of India with respect to chemicals, and earlier this year guided similar work in China and Mexico. During the war he was the first general manager of one of the nation's earliest atomic energy production units and served as director of training for the U. S. Coast Guard in the Third Naval District.

Starting with the selection of plant sites and working throughout with local contractors, Hartford-Empire's Glass Plant Engineering Department will offer the industry acceptance of full responsibility for each job, right on to initial production of containers. This is said to be the first time that such single responsibility has been available to the industry, as consulting engineers have normally shared responsibility with contractors and glass manufacturers.

The new department will combine Hartford-Empire's long-time knowledge of glass manufacturing problems, coupled with years of consulting work in glass plant layout and construction. It is the first time in the company's 35-year history that such a complete service has been offered. Singleness of responsibility is expected to result in the type of over-all economy necessary in the current building market.

While Hartford-Empire's work will be of an individual and strictly confidential nature, the company will offer standardized designs for "package" plants destined for the production of specific items, such as baby foods or single-trip beer bottles, thus achieving further construction economies.

Immediate interest is expected in the industry with respect to the improvement of working conditions, elimination of fire and other hazards in existing plants and the replanning of shops to accommodate the new, higher speed machines.

DIAMOND ALKALI ARRANGES TEMPORARY HOUSING OF ADMINISTRATIVE HEADQUARTERS

According to an announcement by President Raymond F. Evans, the Diamond Alkali Company, second largest producer of chemicals in its field, has leased 22,000 square feet of space on the third floor of the Union Commerce Building for the temporary housing of its administrative headquarters as the first step in its move to Cleveland.

Permanent administrative headquarters of the company are to be located in Mayfield Heights, where the company is planning the construction of a 2½ to 3 million dollar administration and research center, provided Mayfield Heights residents, in the November 4th election approve required changes in the village zoning ordinances.

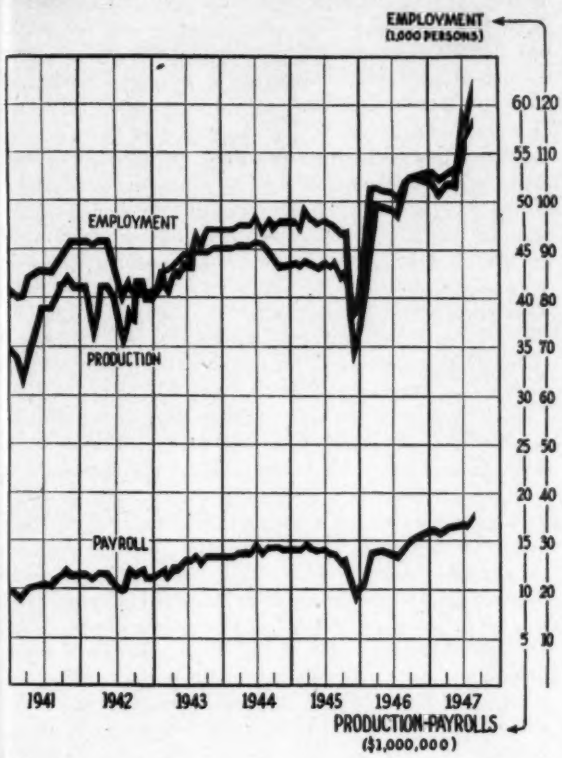
Plans call for centering in Mayfield Heights both the company's general office staff of about 150 people, most of whom will move there from Pittsburgh, and 200 engineering and research technicians, most of whom will be transferred from their present location in the company's Painesville plant.

President Evans believes that by combining, under one roof, Diamond's executive personnel with the operating and research personnel now located at Painesville, a better over-all direction of the company's affairs will be achieved.

It is expected that the company's executive staff will occupy its new temporary headquarters in the Union Commerce Building by approximately May 1.

CURRENT STATISTICAL POSITION OF GLASS

THE GLASS INDUSTRY'S INDEX



Activity in the glass industry during the month of August 1947 jumped close to 7 per cent to an estimated $62,500,000, according to the Production Index. Activity during the previous month, July, had been reported to be an approximate $58,700,000. During August 1946, production was $51,500,000, which is about 21 per cent below August this year. Total estimated production at the close of the first eight months of 1947 is $464,700,000, as compared with $383,500,000 during the corresponding period in 1946.

Employment and payrolls: Employment during the month of August 1947 rose close to 4½ per cent to a total of 118,000 persons employed. During July this figure was 113,000 persons. Employment during August 1946 was 104,000, which is about 13 per cent below August this year.

During August 1947, glass manufacturers paid out an approximate $17,500,000 in salaries. This figure is a little more than 6½ per cent over the $16,400,000 paid out during July. Payrolls during the month of August 1946 were an approximate $14,000,000, or 25 per cent below August 1947. During the January-August 1947 period, glass manufacturers have paid out an estimated total of $130,400,000, which is about 38 per cent above the $94,000,000 paid during the same period in 1946.

Glass container production, based on figures released by the Bureau of Census, fell off only slightly for the month of September 1947 to a figure of 9,389,852 gross. Production during August was 9,476,209 gross. During September 1946, production was 9,814,496 gross, or about 4 per cent over September this year. Total glass production at the close of the third quarter of 1947 is 89,263,746 gross, as compared with 86,262,711 gross at the close of the corresponding period in 1946.

Shipments of glass containers during September fell off only slightly from the 9,200,486 gross shipped during August to 9,159,716 gross during September. Shipments during September 1946 were 9,777,660 gross, which is about 6 per cent above September this year. Total shipments made through the third quarter of 1947 are 85,157,913 gross, as compared with 86,249,309 gross shipped during the same period in 1946.

Stocks on hand at the close of September 1947 are 7,477,653 gross, as compared with 7,300,442 gross at

(*Continued next page*)

GLASS CONTAINER PRODUCTION AND INVENTORY

(All figures in gross)

		Production September 1947	*Stocks September 1947*
Foods, Medicinal & Health Supplies; Chemicals, Household, Industrials; Toiletries & Cosmetics	Narrow Neck	3,146,404	2,987,809
	Wide Mouth	2,718,253	2,262,790
Dairy Products		310,555	230,213
Home Canning		286,513	383,898
Beverages, Returnable		1,176,382	534,044
Beverages, Non-returnable		.....	.....
Beer, Returnable		319,773	311,778
Beer, Non-Returnable		409,622	264,356
Liquors		660,211	260,741
Wines		196,337	148,342
Packers' Tumblers		165,802	93,682
Total		9,389,852	7,477,653

GLASS CONTAINER SHIPMENTS

(All figures in gross)

	September 1947
Narrow Neck Containers	
Foods	1,528,012
Medicinal & Health Supplies	945,279
Chemical, Household & Industrials	389,880
Beverages, Returnable	1,044,866
Beverages, Non-Returnable	.....
Beer, Returnable	238,204
Beer, Non-returnable	393,564
Liquors	603,863
Wines	173,834
Toiletries & Cosmetics	364,252
Sub-Total (Narrow)	5,681,754
Wide Mouth Containers	
Foods	2,049,494
Dairy Products	289,648
Home Canning	227,294
Medicinal & Health Supplies	228,838
Chemical, Houeshold, Industrials	61,862
Toiletries & Cosmetics	107,040
Packers' Tumblers	139,634
Sub-Total (Wide)	3,103,810
Total Domestic	8,785,564
Export Shipments	374,152
Total Shipments	9,159,716

Attention . . .

Glass Tank Operators

For Maximum Life SPECIFY

C · S · R

CAST SUPER REFRACTORY

For

Mantels, Feeder Parts, Tuckstones, Burner Blocks, Port Covers, Port Bottoms, Port Arches, Port Skews, Port Baffles, Lintels, Jambs, Bridge-wall Covers, etc.

C.S.R. *has excellent resistance to*

HIGH TEMPERATURES

CORROSION

SHRINKAGE

SPALLING

C.S.R. *is*

VACUUM CAST

ACCURATE TO SIZE

UNIFORM TEXTURE

ECONOMICAL

●

Write for Full Particulars

WALSH REFRACTORIES CORP.

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the close of August and 3,942,188 gross at the close of September 1946.

Plate glass production for the month of September 1947 was 20,648,053 sq. ft., which represents a decrease of about 3 per cent from the 21,401,330 sq. ft. produced during August. During September 1946, 21,142,287 sq. ft. were produced. Total plate glass production during the first nine months of 1947 is 190,188,262 sq. ft., as compared with 147,543,875 sq. ft. produced during the first nine months of 1946.

Automatic tumbler production dropped off a little more than 15½ per cent for the month of September to a figure of 4,936,785 dozens. Production during August was 5,854,125. During September 1946, production was 6,710,674 dozens. Shipments for September, however, increased close to 30 per cent. Shipments for the month were 6,321,806 dozens as compared with 4,867,231 dozens shipped during the preceding month. Shipments during September 1946 were 6,077,694 dozens. Stocks on hand at the close of September 1947 were 7,940,031 dozens, which is about 2 per cent less than 8,158,257 dozens on hand at the close of August. Stocks at the close of September 1946 were 5,352,309 dozens.

Table, kitchen and household glassware: For the month of September 1947, manufacturers' sales of machine-made table, kitchen and household glassware dropped about 6 per cent to 3,430,381 dozens. The August figure was 3,644,923 dozens. Sales for the month of September 1946 were 3,645,278 dozens. Total manufacturers' sales during the 12-month period ending September 1947 were 40,902,945 dozens, as compared with 45,504,474 dozens sold during the corresponding period in 1946.

Because of lateness, one company's figures are not included in the figures for automatic tumbler production and table, kitchen and household glassware. However, the totals for this company have been estimated for the compilation of the above figures.

HIBBERT TO HEAD PRESS RELATIONS AT LIBBEY-OWENS-FORD

G. P. MacNichol, Jr., Vice-President in charge of sales, recently announced the appointment of Wilfrid Hibbert, former newspaperman, as press relations manager of Libbey-Owens-Ford Glass Company.

Mr. Hibbert, who has been a member of the L-O-F public relations staff for nearly two years, succeeds Earl Aiken, recently named general sales promotion manager. Both assignments are in public relations department headed by James M. Ashley.

From 1919 to 1941 Mr. Hibbert was on the editorial staff of the Toledo Times, serving the last three years as city editor. As a reserve Army officer commissioned in World War I, he was called to active duty in 1941, for a time was Chief of the Press Branch in Washington, D. C., and later Area Public Relations officer for U. S. Forces in Kunming, China. In the present Army reserve organization he commands the 259th Composite Group, Second Army, holding a commission as colonel in the Coast Artillery corps reserve. He was awarded the Bronze Star medal with oak leaf cluster for his service in China.

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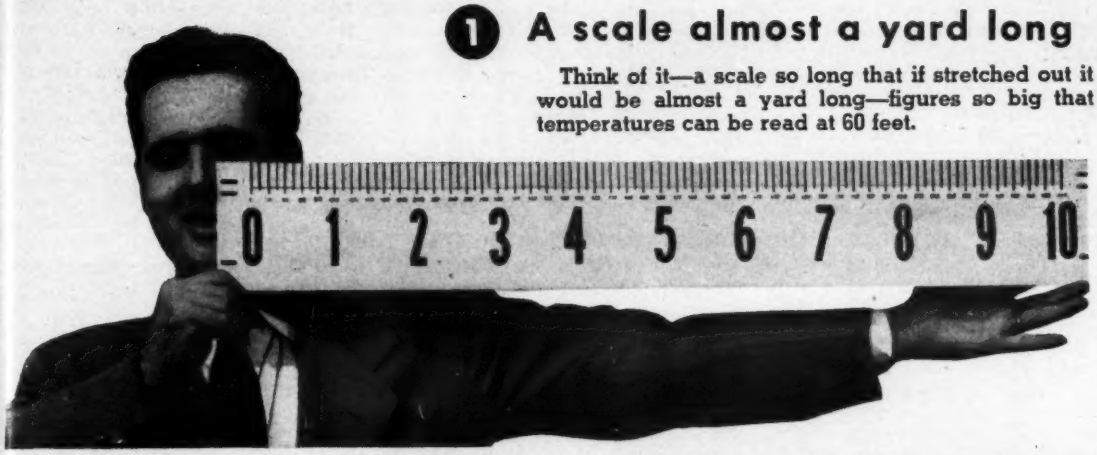
1 A scale almost a yard long

Think of it—a scale so long that if stretched out it would be almost a yard long—figures so big that temperatures can be read at 60 feet.



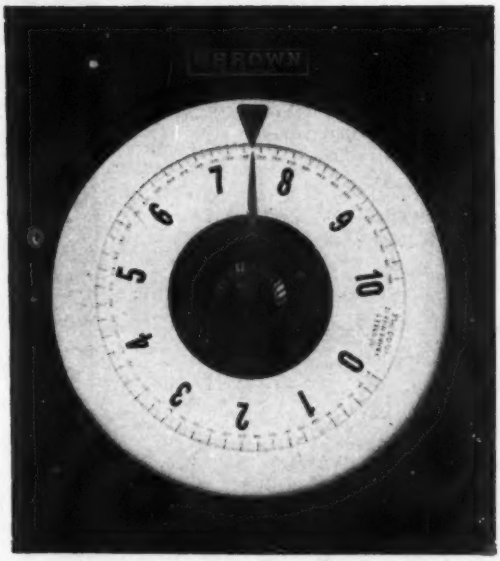
2 ElectroniK performance

3 LOW in first cost and MAINTENANCE

All these features plus many more belong to the new Brown ElectroniK Circular Scale Indicating Controller.

This new electric controller is not only a model of utility, but a model of simplicity as well. That is why you get so much in performance at such a reasonable price.

An interesting catalog will be sent to you without obligation. Write for Catalog 15-11.



4 Reads 12 o'clock

when at the control point. A large adjustable index on a rotating scale indicates the control set point; a fixed triangular index at the 12 o'clock position indicates actual temperature. Any variation from the control point can be read directly in temperature degrees.

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NEW EQUIPMENT AND SUPPLIES

DU PONT ANNOUNCES NEW SILICA

E. I. du Pont de Nemours and Company has announced a new silica called "Ludox" colloidal silica, a fluid, opalescent aqueous dispersion containing the elements of common sand in a relatively high state of purity and in a finely divided form.

Because of its unique chemical and physical properties, this new silica, "sol" promises to be of value in many industrial products.

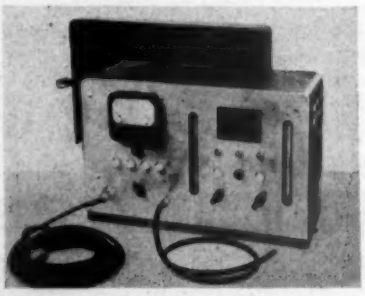
"Ludox" sols are prepared by a patented process involving the reaction of aqueous sodium silicate with a cation or base exchange resin and are essentially salt and sodium free. "Ludox" is highly fluid, even in concentrated form, and on drying yields substantially pure silica in the form of thin films or finely divided, discrete particles which cannot be re-dissolved in water. Colloidal solutions of 18 per cent silica concentration are already available, and it is expected that a 30 per cent solution will be ready for distribution early in 1948. Such solutions can be stored indefinitely without any settling or gelation. They can, however, be readily precipitated or gelled, if desired, by the addition of certain salts or organic substances.

DAVIS INTRODUCES NEW ANALYZER OF GASES IN THEIR TOXIC RANGE

A new Micro-Gas Analyzer for determining and analyzing the concentration of gases or vapors in their toxic range has been introduced by the Davis Emergency Equipment Co., Inc., 45 Halleck Street, Newark 4, New Jersey.

The analyzer works on the principle of electrical conductivity of solutions. Any gas, therefore, which will ionize in water, with or without heat may be analyzed in the toxic range.

In operation, the gas is drawn into the analyzer by a small pump. The gas passes through a flowrator and then enters a combustion furnace, where it is decomposed. From the furnace, the gas passes into the cell through which the solution is being pumped. As the decomposed gas dissolves in the water, the electrical conductivity changes. This permits a greater flow of current between the electrodes, which is measured on a meter in Parts Per Million of the gas being analyzed. After the solution passes by the cell, it is pumped through a special unit which de-ionizes the solution and returns it to the cell in its original state.



Many different gases may be analyzed by the New Davis Micro-Gas Analyzer. Included with instrument is a chart which indicates the flow rate of both water and air for the gas being determined. The analyzer is portable, weighing approximately 33 pounds. Operates from 110 AC, 60 cycle.

NEW DUMPER SAVES TIME AND LABOR

A new development for lifting and dumping quantities of free flowing materials, known as the Cesco Dumper,

was recently announced by the Colson Equipment & Supply Co., of Los Angeles, Calif. The manufacturers claim that this dumper is a practical time and labor saving piece of equipment, adaptable to many different types of manufacturers, processors and distributors.

The Cesco Dumper can be used for liquids, as well as solids and semi-solids. The material is placed in the skip of the dumper, a switch is turned and the skip with its load is automatically lifted and emptied into bins.

The Cesco Dumper is equipped with a 500 pound capacity box type skip for loose materials or liquids, or an open front skip for bagged materials. Stainless steel skips may be had if desired. The open front skip contains spikes which hold the opened bag in place while lifting and dumping. It is claimed that one hundred trips an hour are possible, and as much as 600 cubic feet or 50,000 pounds may be lifted and dumped within that time.

FOXBORO ANNOUNCES PNEUMATIC TRANSMITTER

A new Transmitter, identified as Model 42, is announced by The Foxboro Company, Foxboro, Mass., for use in the pneumatic transmission of industrial process measurements such as flow, static or differential pressure, liquid level, temperature or humidity. It is an indicator-type instrument, available with either an eccentric or concentric scale, both being designed for quick and easy reading.

The Model 42 Transmitter is essentially an improved design of the previous Foxboro Transmitter, but the changes are sufficient, both in number and importance, to qualify it as a new instrument.

CATALOGUES RECEIVED

Foxboro Company, Foxboro, Mass., has recently announced the publication of a 36-page Bulletin 277-2 entitled "Pneumatic Control Valves and Controller Accessories."

Among the features of the new bulletin are a color page showing the various identifying enamel finishes offered on Stabilflo Valves, plates and tables of specifications for the various valves, separate sections on the Vernier Valvacator for high accuracy positioning of valve plungers, and on air switches and sub-panels for remote valve controls.

The Cambridge Wire Cloth Company, Cambridge, Md., has published a booklet in reprint form entitled "Woven Wire Conveyor Belts for Industrial Applications, written by S. Craig Alexander. The booklet covers varied phases of the woven wire belts such as metals and alloys used in conveyor belt construction and the numerous applications of woven wire conveyor belts for industrial purposes.

National Airoil Burner Co. has issued a bulletin entitled, "National Airoil Tandem Combustion Unit" which describes in detail this unit used for combined gaseous and oil fuels. This new unit will operate with high combustion efficiency using either gas or oil fuel; also with a minimum of furnace draft, all grades of oil fuels, and all grades of gas fuels at 5 pounds or higher pressure. The bulletin contains numerous illustrations and diagrams.

Fisher & Porter Company, Hatboro, Penna., announces that there is now available a new 32 page bulletin entitled "A New Era in Liquid & Gas Flow Measurement" containing many illustrations and informative material describing the numerous advantages of the Flowrator meter (formerly called Rotameter) for flow rate measurement. Clearly discussed are important topics such as: Basic Principles . . . Flexibility . . . Extremely high accuracy . . . Linear flow characteristics . . . Wide flow range, and many other subjects of interest to the engineer unacquainted with variable-area type of flow measurement instruments.

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O. N. Break Type BOTTLE TESTER

BREAKING PRESSURE is temporarily recorded by a manual reset free pointer.

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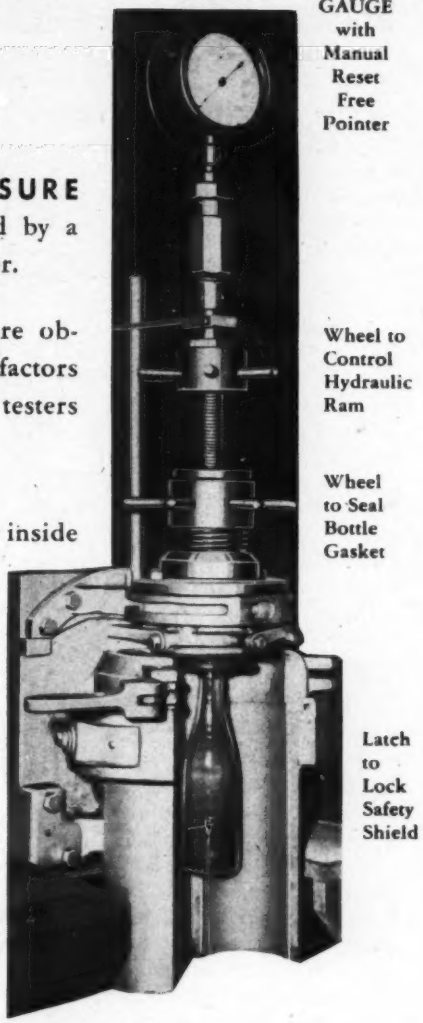
UNIT FOR TESTING VARIOUS KINDS AND SIZES OF CONTAINERS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"MISSISSIPPI GLASS" HONORED BY BRAND NAMES FOUNDATION

"Mississippi Glass," manufactured by the Mississippi Glass Company of St. Louis since 1884, was among the sixty brand names which received a Certificate of Public Service from the Brand Names Foundation for 50 or more consecutive years of service to the American consumer, at a dinner held at the Coronado Hotel in St. Louis on Sept. 29th and sponsored by the Advertising Club of St. Louis and the Brand Names Foundation.

A Certificate of Public Service was presented to Dr. J. C. Hostetter, President of the Mississippi Glass Company, by Henry E. Abt, President of the Brand Names Foundation before a gathering of more than 400 business and industrial executives of the St. Louis and midwestern areas.

The sixty brand names awarded the Certificates of Public Service at the dinner represented a wide cross section of American industry. All were honored by Brand Names Foundation as "products which have been tested by the American people for fifty consecutive years or more and have won and held public confidence through unfailing integrity, reliable quality and fair pricing."

BOOK REVIEW

N. N. Kachalov, Professor of Glass Technology, Leningrad Technological Institute, published a monograph in Russian on "The fundamentals of the grinding and polishing processes as applied to glass," 275 pages, 186 figures.

The volume, although it takes into consideration all the published information, is first of all a report on the work done by the author and his school. Over 1500 experiments were carried out to elucidate the effects of the nature of the abrasive, its grain size, its amount, the amount of water supplied, the pressure of grinding, the rate of rotation, and so on. The rival theories of grinding are critically compared.

• Victor S. Carter, who has been sales representative of Libbey-Owens-Ford Glass Company in the Kansas City area, has been appointed district manager for New England with offices at 1437 Statler Building, Boston, effective Oct. 1, it was announced by G. P. MacNichol, Jr., vice-president in charge of sales. Mr. Carter succeeds the late A. O. Duhamel who died August 28.

CANADA MAY SET UP IMPORT CONTROLS

Canada's currency troubles in not having enough U. S. dollars to pay for her imports from across the border have increased the possibility of her establishing import controls over goods brought across the international border. This would affect the glass industry of the United States, since glass imports from U. S. have been increasing rapidly this year and taking away large sums of U. S. dollars.

At the same time, it is supposed that, if such a policy of restricting U. S. imports should be enacted to conserve American dollars, it is quite likely that so-called "non-essential" articles might be the first to suffer such adverse effects of the economic axe to be swung by the Canadian authorities, though there are viewpoints which differ considerably what category may be termed the products of the U. S. glass industry. It is questionable if any drastic and arbitrary curb on glass imports into the Canadian market from the U. S. would be made at this time since much of the Canadian imports along these lines are anything but "luxury" goods or "non-essential" articles in a practical interpretation of these terms.

However, it would not be surprising if there is some slow down of glass imports moving into the Canadian market when or if such restrictions are made on account of the increase of shipments lately. In fact, in the first half of 1947, for example, the increase of such shipments are shown by the following imports, with last year's figures being given in brackets: heat resisting glass ware, $1,300,177 ($1,264,370); common colorless window glass, $691,912 ($486,193); Glass carboys, bottles, jars, $3,339,939 ($1,849,374); glass tableware, cut glass, etc., $1,074,693 ($792,105); glass shades or globes, $43,005 ($25,086); glass lenses, $198,866 ($147,828); moulded shapes for electric fixtures, $796,030 ($569,024); plate glass not over 70 sq. ft., $522,884 ($368,100); plate glass 7 to 25 sq. ft., $379,497 ($143,600); glass sheets, bent plates, $208,706 ($171,236); glass to be cut or mounted, $318,155 ($239,402), and others, all showing the rapid increase of such U. S. glass products into the Canadian market during 1947 and emphasizing the stake involved in possible restrictions of such imports on account of the U. S. dollar shortage in Canada at the present time.

CERAMIC SECTIONS HOLD JOINT MEETING

The November meeting of the Pittsburgh Section of the American Ceramic Society will be in the form of a combined session with the Pennsylvania Ceramics Association, and a trio of well-known men in the Ceramics field will speak. The talks, centered around the mineralogy of Ceramic raw materials, will be:

Ceramic Materials from the Standpoint of the Petrographer, by Dr. J. C. Griffiths.

Investigation of Clays with the Electron Microscope, by Dr. T. F. Bates.

The third speaker will be Dr. K. Rugh whose subject has not yet been announced.

The meeting will be held in the Mellon Institute auditorium on Tuesday, November 11, 1947 at 8:00 P.M.

The fellowship banquet which precedes the meeting will be especially interesting this month due to the presence of Ceramic men from Pennsylvania and surrounding states. Reservations may be made through Mr. Neal Brandt, Mellon Institute, Pittsburgh (13), Pa.

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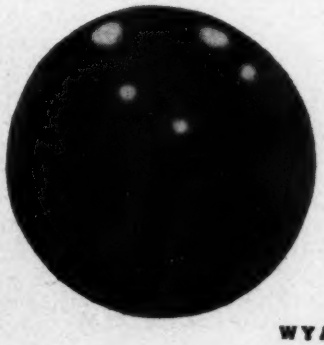
That's the keynote of Wyandotte Technical Service. Every step of the way—from the first sample of the chemical adapted to meet your needs to the sale of your finished product—this complete service is at work for you.

Today, as in the past, experienced Wyandotte Technical Service Men are advising many Wyandotte customers in such problems as the design of chemical storage facilities and processing equipment . . . in the proper methods of handling, sampling, analyzing and using bulk chemicals.

All of this adds up to greater value for you in Wyandotte Chemicals. If you have any problems concerning the chemicals listed below, *why not ask Wyandotte?*



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Wyandotte
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(*Continued from page* 566)

generally ranges between 8.0 and 11.0 per cent. The extreme values are 6.9 per cent and 14.7 per cent; 1946 glasses show a continuation of the trend towards higher lime percentages.

Sodium and potassium oxides, Fig. 8d, range from 12.6 to 18.9 per cent. Most of the glasses are included in the range 15.0 to 17.0 per cent. Alkali values remain close to 1945 levels.

Percentages of boric oxide, Fig. 9b, range from 0.0 to 1.3. In 1946, 25 per cent fewer glasses contained boric oxide in amounts greater than 0.1 per cent than in 1945.

Fluorine was used in about the same number of glasses in 1946 as in 1945. The percentage of fluorine generally used has increased from 0.20 in 1945 to 0.25 in 1946, and many more glasses contain over 0.3 per cent.

Sulfate is found in all flint glasses. The percentage ranges from 0.05 to 0.40 per cent. Most glasses contain between 0.10 and 0.30 per cent. The distribution is similar to that for 1944 and 1945 glasses.

Fig. 10 shows the percentage of glasses containing combinations of none, one, two, three, and four minor constituents. The 1946 data compared with 1945 show an increase of about 10 per cent in the number of glasses containing two extra constituents, and a 10 per cent decrease in the number of glasses containing four extra constituents. The percentage of glasses containing one and three minor constituents remains the same as in 1945.

Thermal expansions, Fig. 11, were measured for nearly all glasses analyzed in 1946. The results are expressed as the coefficient of thermal expansion per degree centigrade for the range 0 to 350°C. The values range from 82 to 102 x 10^{-7} per °C, the most common being 93.

c) Seed Counts. Based on the seed counts of the flint glasses covered in this survey, the logarithmic average is 20 seeds per ounce. This means that owing to the nature of the distribution of the results, the number of glasses having a seed count of less than 20 is equal to the number having a seed count greater than 20.

(*Continued on page* 590)

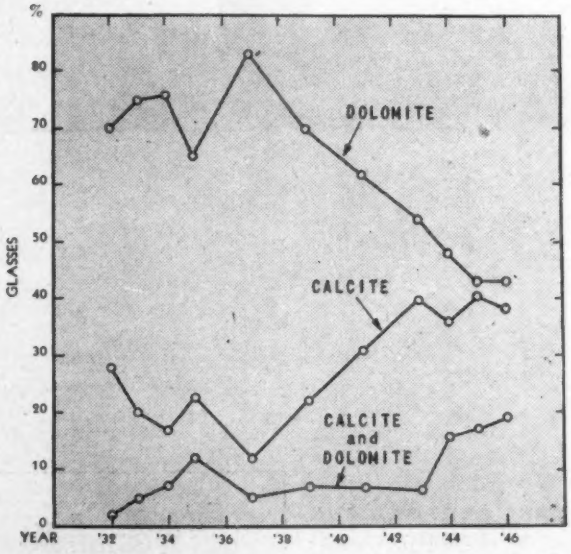
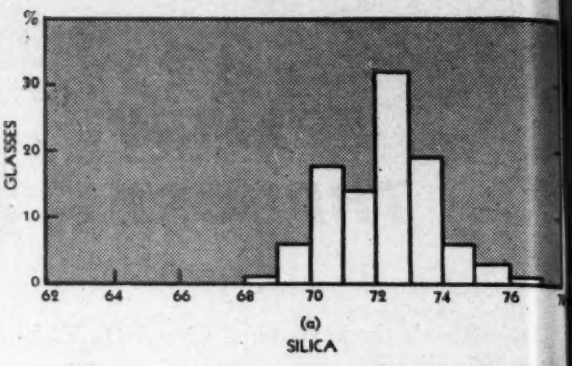
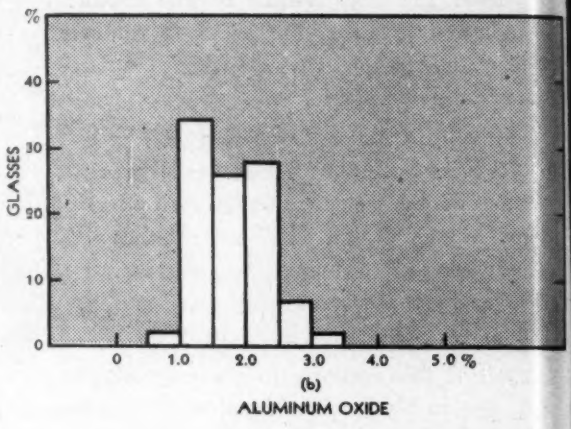
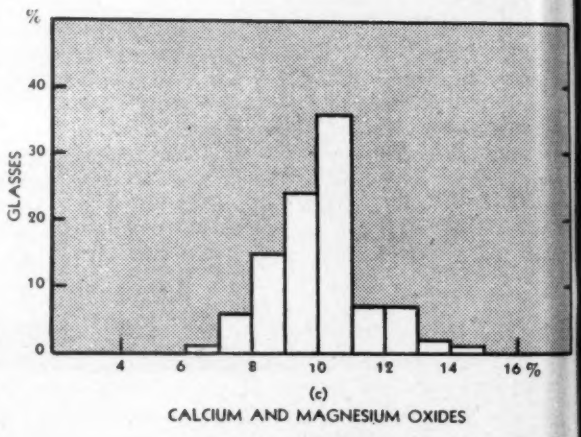


FIG. 7
USE OF CALCITE AND DOLOMITE LIME







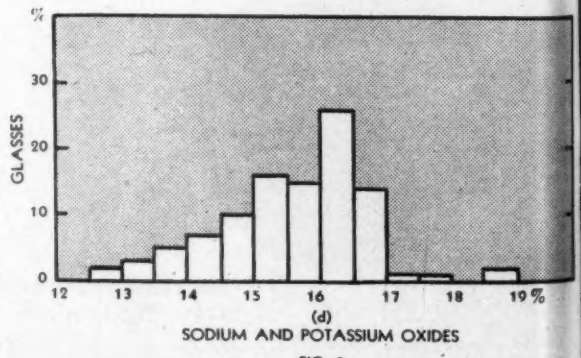


FIG. 8

SMOOTH FINISHES

AT PRODUCTION LINE SPEEDS with the 3M WET GRINDING METHOD

Grind or Bevel Edges Without Chipping! Grind Safety Glass Without Burning or Discoloring!

The 3M Wet Grinding Method gives you a high-speed precision method of beveling or pencil edging glass. Its automatic cooling of the abrasive belt reduces danger of breakage and keeps the abrasive in top shape for extra hours of faultless grinding.

Mold marks and surface imperfections are removed at production line speeds with a minimum of rejections; every job is turned out with the smooth, clean finish that has made glass manufacturers enthusiastic about the 3M Method. Powdered glass is eliminated and along with it the danger of silicosis.

Ask your nearest 3M Distributor for information about the 3M Wet Grinding Method, or send for your free copy of our booklet entitled "A Faster, Better Finishing Method." Address Dept. GI 1147 at the address below.

CONTAINER GLASS COMPOSITIONS . . .
(*Continued from page* 588)

The distribution of seed counts is shown in Fig. 12. Twenty-five seeds per ounce is the most common. Although the average seed count for 1946 was the same as for 1945, there has been an increase in the percentage of glasses having seed counts over eighty-five, and the most common seed count has increased from fifteen in 1945 to twenty-five in 1946.

d) Homogeneity. Based on the homogeneity ratings of the flint glasses covered in this survey, the logarithmic average of the ratings is B.

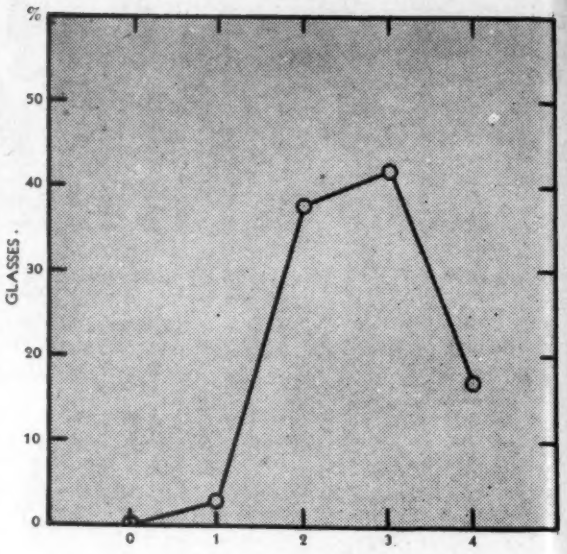
The distribution of the homogeneity ratings is shown in Fig. 13. A rating of B is the most common. There has been no significant change in the average and distribution of homogeneity ratings compared with the previous year.

e) Chemical Durability. The chemical durability against both water and acid attack was determined for almost all of the glasses. The tests were made according to a method proposed as a tentative A. S. T. M. test for glass in the form of grains. The results are expressed as the per cent of sodium oxide extracted by the attacking medium. Fig. 14 shows the distribution of the results for water attack, and Fig. 15 for acid attack. The average durability against water attack is 0.035 per cent sodium oxide extracted, and against acid attack 0.050 per cent sodium oxide extracted.

Summary

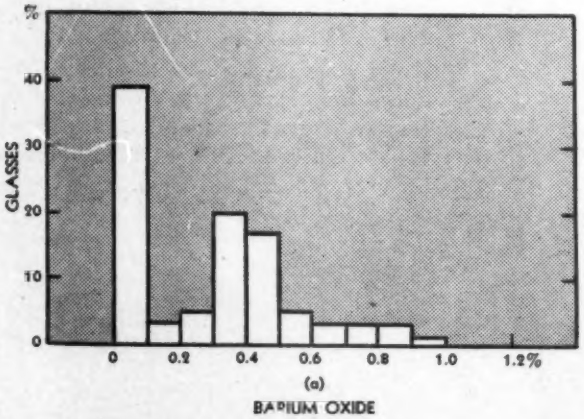
The general conclusion to be drawn from this report is that container-glass compositions have on the average decreased in silica and alkali contents as the total of lime plus other stabilizing oxides has increased steadily from 9 to nearly 12 per cent in the fifteen-year period, 1932-1946. During this time, glasses have become more and more complicated by the use of minor constituents intended primarily to assist melting and fining.

(*Continued on page* 592)

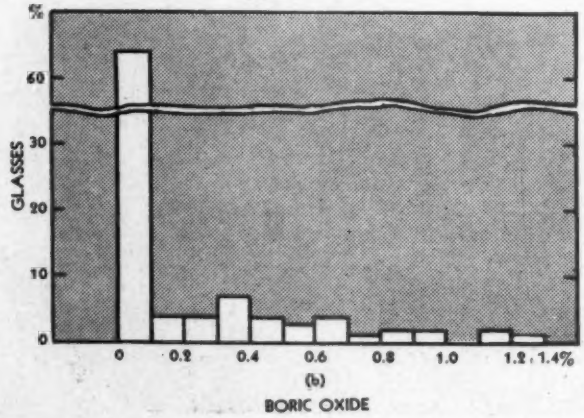


NUMBER OF EXTRA CONSTITUENTS IN 1946 GLASSES.

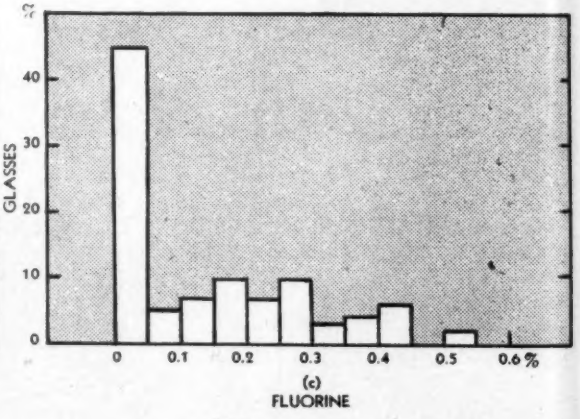
FIG. 10



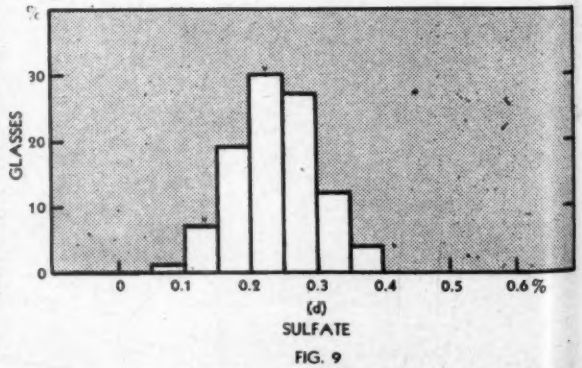
(a)
BARIUM OXIDE



(b)
BORIC OXIDE



(c)
FLUORINE



(d)
SULFATE

FIG. 9

TIP for TABLEWARE MANUFACTURERS

Kryolith

REG. U.S. PAT. OFF.

THE NATURAL CRYOLITE FLUX

Na_3AlF_6

If you use 30 lbs. of Kryolith per 1000 lbs. of sand, you get the equivalent of:

22.7 lbs. Soda Ash* **16.3 lbs. Fluorine***

11 lbs. Aluminum Hydrate

*Because fluorine reduces the softening point of glass, you can reduce the soda still further without increasing the cryolite. In the case above, for example, 30 lbs. of Kryolith actually replaces 37 lbs. of soda ash, instead of 22.7 lbs.

GLASS, CERAMICS, ENAMELED GOODS

gain these 3 advantages with Kryolith flux and opacifier

1. KRYOLITH IS UNIFORM—the natural mineral is carefully refined to our high standard of quality. Thus you can depend on its uniformity when you formulate.

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PENN SALT CHEMICALS

Next time you formulate, do as many leading manufacturers are doing—use Kryolith, the natural cryolite flux and opacifier. Why not try it out right now?

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CONTAINER GLASS COMPOSITIONS . . .

(*Continued from page* 590)

It should be noted, however, that the range of compositions found in 1946 exceeds both ends of the trends in composition shown for the past fifteen years. Glasses of more than 74.0 per cent silica, less than 9.0 per cent lime, and more than 17.0 per cent alkali are still to be found. There are also those glasses which lead the current trend with lime in excess of 14.0 per cent and alkali of less than 13.0.

Undoubtedly the typical glass of 1946 is superior in many respects to the glasses of former years. Certainly, resistance to chemical attack and to weathering has been greatly improved. The record of the industry in improving both melting and forming efficiencies over the years is a further indication of the values obtained from modern glasses.

It is indeed interesting to speculate on the limits of lime and alkali contents in container glasses. Certainly glasses of 12.0 per cent alkali are to be expected soon and the lime content may easily exceed 15.0 per cent. Possibly what we consider modern is simply a return to early practice in which bottles and window glass were produced from the same furnace. Certainly many of the container glasses represent the same lime and alkali contents as those commonly associated with window and plate glass manufacture.

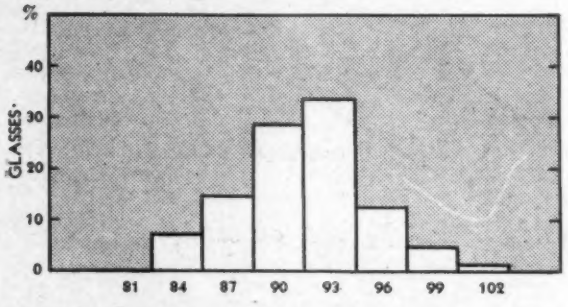

FIG. 11

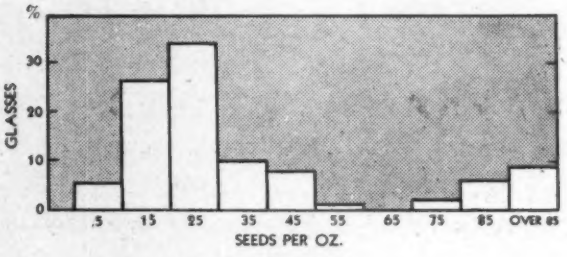

FIG. 12
DISTRIBUTION OF PERCENTAGES OF GLASSES
IN RESPECT TO SEED COUNT

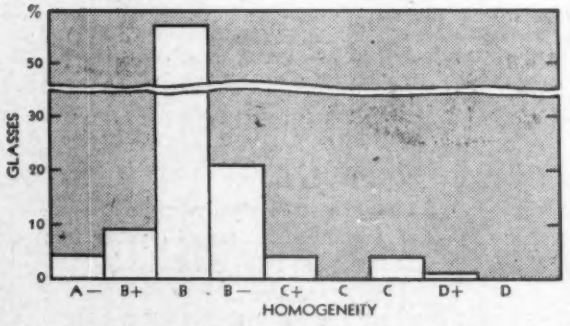

FIG. 13
DISTRIBUTION OF PERCENTAGE OF GLASSES
IN RESPECT TO HOMOGENEITY

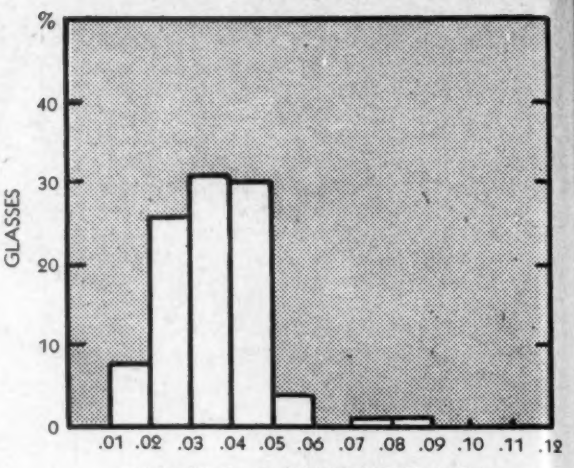

FIG. 14

DISTRIBUTION OF PERCENTAGE OF GLASSES
IN RESPECT TO CHEMICAL ATTACK BY WATER

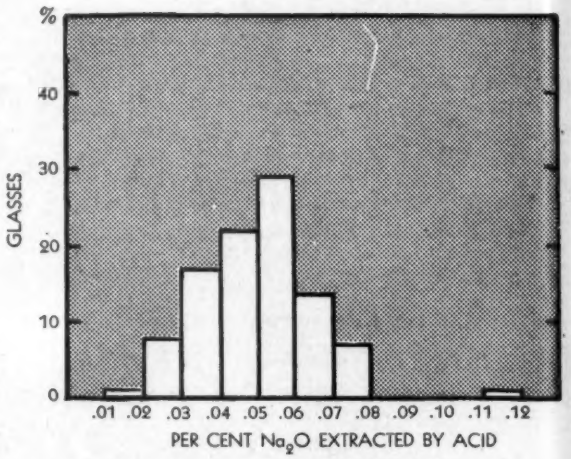

Fig. 15

DISTRIBUTION OF PERCENTAGE OF GLASSES
IN RESPECT TO CHEMICAL ATTACK BY ACID

GLASS EXPORT FROM GERMANY IMMINENT

The Executive Committee for Economics of the American and British Zones of Germany has planned for 1948 a production of over 200,000 tons of flat glass, valued at $30,000,000, and 100,000 tons hollow glass, valued at $20,000,000; of which there is scheduled for export 20,000 tons of flat and 6,000 tons of hollow glass of a combined value of over $5,000,000.

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● You won't get far by visualizing formulae with spheres and rods. You rob yourself of time, delay action on other important work, when you "go it alone" in trying to solve a color problem. But we feel certain that Drakenfeld know-how and research facilities can help you find the answer.

By working closely with production chiefs in the glass and ceramic industries, our skilled technologists have developed countless colors to meet individual specifications and production methods. When we formulate a color for you, you can rest assured that each re-order will be handled with the same strict control of every manufacturing step as the original. That's one reason why manufacturers of glass and ceramic ware depend on Drakenfeld service and rely on Drakenfeld colors, coloring chemicals and supplies.

Let us discuss your particular color problem when it's convenient to you. We feel certain our many years of experience can help you realize greater production, fewer rejects and better, more profitable ware. Give us your requirements. Write Drakenfeld today.

DEPENDABLE SERVICE ON: Acid, Alkali and Sulphide Resistant Glass Colors and Enamels . . . Crystal Ices . . . Squeegee and Printing Oils . . . Spraying and Banding Mediums . . . Glassmakers' Chemicals . . . Glass Decolorizers . . . Decorating Supplies.

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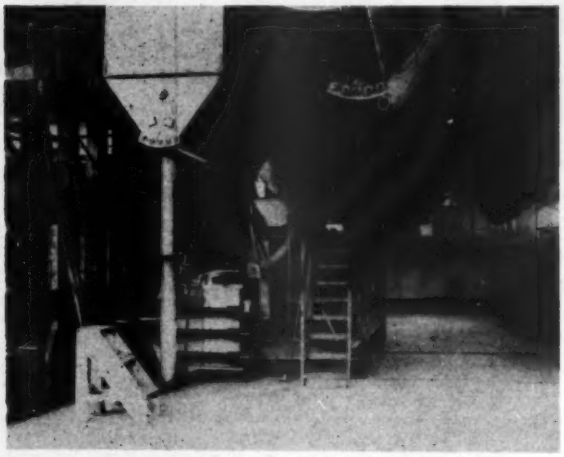
MODERN EQUIPMENT AND LAYOUT DISTINGUISH THE NEVILLE ISLAND PLANT . . .

(*Continued from page* 571)

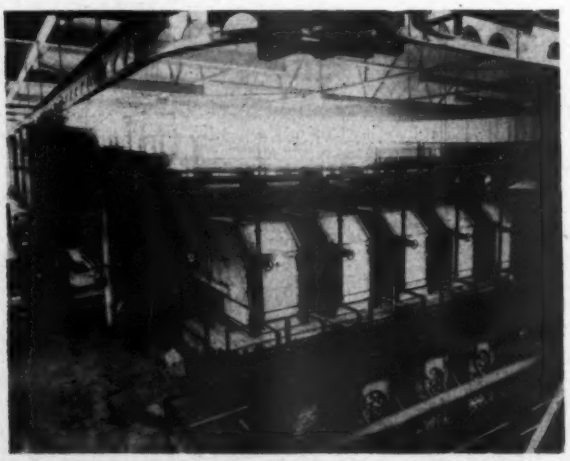
floor level where moulds are made, finished, repaired, or stored. A platform elevator starting at the ground floor level serves the lehr room and the mezzanine floor where paper cartons are fabricated. All cartons are formed and stored on the mezzanine floor with gravity chutes supplying the assembled cartons to the packing end of the six lehrs below. The glass is packed and stored on wooden pallets and is conveyed from the lehr building into the warehouse by fork lift trucks.

The fuel used throughout the plant is a by-product coke oven gas supplied by the Pittsburgh Coke & Chemical Company which is located less than a mile away.

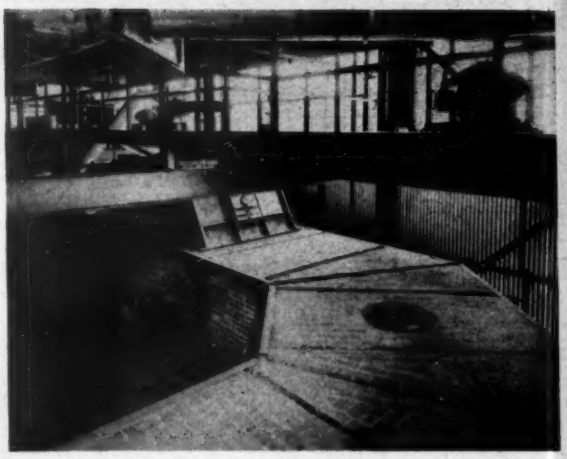


View of the charging floor and batch gallery showing batch storage and containers in feed position over the Simplex blanket batch charger.

This fuel averages approximately 530 BTU's per cubic foot and has proved to be exceptionally efficient for glass melting. The furnace was especially designed for the application of this coke oven gas and melting results have exceeded the most optimistic preliminary estimates of fuel economy.



Side view of furnace showing interconnecting system of catwalks which provide access to all vital points in the manufacturing end of the plant.



View of cat-walk beneath ports showing block cooling system.

With the difficult fuel situation, which has plagued many industrial operations in this district the past few winters, this fuel factor provides the glass company with a most encouraging outlook. While other industries are faced with the possibility of having to resort to emergency fuel systems on occasion, Neville Island Glass Company looks forward to continuous operation with its prime fuel.

In designing this plant, careful consideration was given to all possible future contingencies which might be encountered with regard to fuel, raw materials, changing markets, and shipping facilities.

In organizing the Neville Island Glass Company, Mr. Dugan not only insisted upon the finest in plant equipment, but he has surrounded himself with a staff of capable and experienced glass men. The officers of the Neville Island Glass Company are: Mr. Walkerman D. Dugan, President; Mr. Herbert C. Abrahamson, Vice-President in Charge of Sales; Mr. R. A. Senkbeil, Vice-President in Charge of Production; Mr. C. P. Franchot, Secretary; Mr. E. M. Westbrook, Treasurer; and Mr. Norman R. Utecht, Plant Superintendent.

The balance of operating personnel was recruited from the Pittsburgh District which has long been an important glass producing center.

Flint glass containers are being manufactured and the plant is equipped to produce wide mouth and narrow neck ware, ranging from fractional ounce prescription and pharmaceuticals to gallon packers' ware.

DIAMOND ALKALI PREPARES FURTHER EXPANSION

A capital outlay much greater than the $20,000,000 already spent by Diamond Alkali Company in its postwar expansion to date will back the company's further development of new products and increased production, President Raymond F. Evans told a round-table conference of sales managers.

In preparation for Diamond's planned expansion, the managers of thirteen branch offices covering the territory from Dallas to Boston, and from Philadelphia west to Oklahoma City, were briefed closely by Fred W. Fraley, vice president, sales; W. H. McConnel, director of sales, and J. A. Sargent, vice president, finance.

UNION PACIFIC

TREASURE MAP OF INDUSTRY

Montana *

WEALTH OF MINERAL DEPOSITS
IMMENSE COAL RESERVES
LARGE LUMBER PRODUCTION
AVAILABLE WATER POWER
ABUNDANT LIVESTOCK
VALUABLE WOOL CLIP
VARIED AGRICULTURE
TREMENDOUS WHEAT YIELD
SCENIC BEAUTY

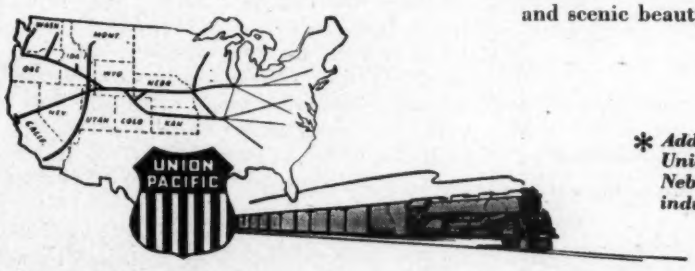
* *One of a series of advertisements based on industrial opportunities in the states served by the Union Pacific Railroad.*

Known as the "Treasure State," Montana is richly endowed with raw materials essential to industrial production. Among the many metallic minerals are silver, copper, lead, manganese, chromium and molybdenum. Coal reserves have been estimated at over 400 billion tons. The majority of the state's cities are supplied with natural gas.

Montana is a top producer of cattle and sheep, the annual sheep production being approximately two million head with a wool clip of great value. In agriculture, wheat takes first rank among grains. Sugar beets, potatoes, together with other vegetables, are grown on its farms. There are many thousand acres of forests, principally pine.

The Union Pacific Railroad serves Butte in the heart of the great mining area, and West Yellowstone—most popular rail entrance to the famous Yellowstone National Park.

Montana welcomes new industry. It has the space, materials, facilities and manpower to encourage firms seeking new locations. Additional advantages are good living conditions, an excellent educational system and scenic beauty.



* *Address Industrial Department, Union Pacific Railroad, Omaha 2, Nebr., for information regarding industrial sites.*

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The constant demand for this useful and informative book has necessitated another printing.

Glass Tank Furnaces is the only book in the English language dealing comprehensively with glass tanks. Its contents include and describe in simple language, the most modern practices in design, construction, operation, behavior and economy of glass tanks. It is a book for the factory man, the technologist and for all who are interested in the practical aspects of glass making.

Glass Tank Furnaces contains 105 figures and illustrations—75,000 words typed in two columns and produced by the lithoprint process. Cloth bound, price $4.00. Foreign $4.50, F.O.B.

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LABOR STILL LIMITING BRITISH GLASS PRODUCTION

Shortage of skilled labor is still the major problem in the British glass industry, and especially so in the hand made sections where an acute shortage of skilled blowers and other operatives, plus decreased working hours and higher wages, all contribute to the problem of meeting demand with an adequate production level. Even in the flat glass industry, where skilled labor is not so vital a problem, the need for workers of experience and quality is such as to retard expansion.

R. W. Johnston, chairman of Webb's Crystal Glass Co. Ltd., remarking on the success of last year's working and on increased net profit, said that the furnaces and auxiliary plant and machinery are in first class order and will be maintained in the highest state of efficiency, enabling his organization to effect economies in manufactures and to keep prices at an economical level. He went on to say that the volume of production increased as far as the amount of skilled and unskilled labor at their disposal permitted. Mr. Johnston attributed the materially improved profits at the works to the modernization of furnaces, plant and machinery.

The shortage of skilled labor was stressed by Cyril Carter, chairman of Carter and Company, Ltd., who control Poole Pottery Works. Said Mr. Carter, "This business suffered lamentably during the war through the loss of skilled craftsmen and it has been a slow job training a new generation to take their place. Progress has been good and the distinguished wares of fine quality, for which the company had made a name for itself, are now being produced again for export. Demands for the special work for which we are known are gradually increasing and we are equipping ourselves by training the necessary craftsmen to carry out such work when it can be undertaken. Costs of fuel and raw materials have arisen against us to detract from what would have been otherwise a still better result in turnover."

RECENT STATISTICS SHOW INCREASE OF HOURLY EARNINGS

Employees of Canadian glass products manufacturers worked an average of 42 hours per week at July 1, 1947, compared with 44.3 at June 1, 1947, or 43.4 at July 1, 1946, according to the latest report of the Employment Statistics Branch of the Department of Trade and Commerce in Ottawa.

This latest report also shows that such employees had average hourly earnings of 76.5 cents at July 1, 1947, compared with 75 cents at June 1, 1947, or 63.1 cents at July 1, 1946.

In addition, there were some interesting facts disclosed in this report on average weekly wages in the glass products manufacturing industry of Canada since at July 1, 1947, such average weekly wages in this industry amounted to $32.13 as against $33.23 at July 1, 1947, or $27.39 at July 1, 1946.

• Solvay Sales Corporation has announced the appointment of Neal M. Draper as Manager of the St. Louis Branch. Mr. Draper succeeds M. S. Johnson, who has been transferred to the Boston Office. Mr. Elmer Seener has been appointed Assistant Branch Manager of the St. Louis Branch.

WHY ARE THESE PARTS BLANCHARD-GROUND?

ILLUSTRATED above are ceramic, quartz, glass, carbon, graphite, agate and granite parts—all ground on a Blanchard Surface Grinder—a standard machine tool known to everyone in the mechanical trades.

Blanchard-Grinding was chosen by the manufacturers of these parts because the Blanchard Method gives all three: ACCURACY, FINE FINISH and A HIGH RATE OF REMOVAL OF MATERIAL—all in *one* operation.

Also, the Blanchard Method often eliminates lapping and the resultant possible contamination of the elements of which the part is made.

Graphite pump vanes (shown above) are ground flat and parallel to less than .0001″. The square quartz slices are ground to a thickness of .011″. Agate slices for semi-precious stones can be ground before or after coloring—ground on both sides and the four edges—with extremely fine finish—and at a high rate of production.

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FOR SALE

GLASS PLANT, CHICAGO HEIGHTS, ILLINOIS

By order of the United States District Court for the Northern District of Ohio, Western Division, Owens-Illinois Glass Company offers for sale as a unit all real estate, buildings, machinery, production equipment (not including molds), tanks and furnaces (except experimental machinery and furnaces) located at Chicago Heights, Illinois, and which were a part of the assets acquired by Owens-Illinois Glass Company from Kimble Glass Company on July 1, 1946.

In accordance with the order of the Court such property is offered for sale for cash to any purchaser approved by said Court, subject to prior sale, at the fair market value of said property as a glassware manufacturing plant, as determined by an appraisal made by The Lloyd-Thomas Company, which said appraisal has been duly filed with the Clerk of said Court at Toledo, Ohio., where it may be inspected. Additions and improvements made to the property described above since July 1, 1946, and prior to consummation of sale are not included in the appraised value aforesaid but are offered for sale as a part of the unit for an additional consideration equal to the cost thereof to Owens-Illinois Glass Company.

In connection with the sale of the property and additions and improvements thereto above described, Owens-Illinois Glass Company will assign or cause to be assigned to the purchaser thereof for the consideration hereinafter set forth, all its rights in and to the following machinery and equipment leased from Hartford-Empire Company situate on said premises on July 1, 1946, to-wit:

4—4 head I S machines with feeders, revolving tube drives and motors, and variable speed drives and motors

1—5 head I S machine with same

2—36" x 74' lehrs, gas fired with top vertical discharge, motor driven steel plate exhaust fan, and all regular equipment

The consideration to be paid by the purchaser to Owens-Illinois Glass Company for the assignment of its rights in the leased machinery aforesaid shall be cash in such an amount as will reimburse Owens-Illinois Glass Company for a fair proportion of any and all payments made in connection with said leased machinery by Kimble Glass Company or Owens-Illinois Glass Company which may be considered as costs of installation, advance payments for minimum annual royalties, license fees, parts, insurance and taxes.

In the event of such sale, possession will be delivered not later than six months after the consummation of such sale to a purchaser approved by the said Court.

Address all inquiries to

Owens-Illinois Glass Company
Attention: F. G. Morfoot
P. O. Box 1035, Toledo 1, Ohio

INVENTIONS & INVENTORS . . .

(*Continued from page* 578)

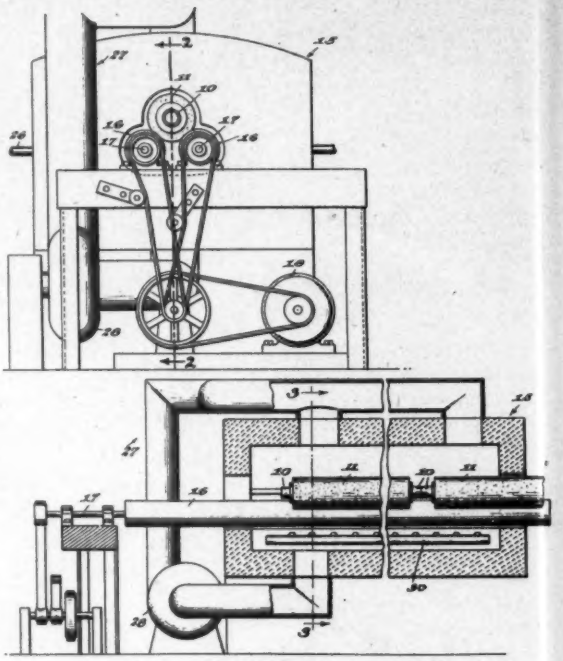

Fig. 5. Glass Wool Pipe Covering.

Shaver, Dec. 26, 1933; 2,016,401, Thomas, Oct. 8, 1935; 2,019,417, King, Oct. 29, 1935; 2,271,829, Powers, Feb. 3, 1942; and 2,351,262, Hahn, June 13, 1944. Foreign Patents: 475,464, Great Britain, Nov. 19, 1937.

Tempering Glass. Patent No. 2,429,129. This patent relates to tempering glass by quenching the hot ware in a liquid bath. The claims are directed to the composition of the bath. It is the invention of George Heppell and Walter Francoeur of Montreal, Canada. This bath purports to give greater strength than has heretofore been possible.

In the use of this invention, the glass is first heated to a temperature somewhat below the softening point and then chilling it in a molten bath consisting of alkali nitrates and/or nitrites to which have been added a small percentage of zinc-aluminum-copper alloy containing a large amount of zinc and small amounts of aluminum and copper. The zinc-aluminum-copper alloy is made according to U. S. Patent No. 1,596,761 dated Aug. 17, 1926, which patent has now expired. This alloy melts at about 650° F. and comprises zinc 93 per cent, aluminum 4 per cent and copper 3 per cent.

In carrying out this invention, the ware is heated to 1150 to 1200° F. The quenching bath is heated to a temperature between 750 and 950 depending somewhat on the thickness of the glass. The time required for quenching may be around one minute. After quenching the ware is placed in a dry furnace at about 400° and then cooled to room temperature. The inventors cannot explain why better tempering is obtained in this way and the law of patents does not require them to explain it.

The gist of the invention is set out in claim one as follows:

A glass tempering medium comprising a molten bath

containing a salt selected from the group consisting of alkali nitrates and nitrites and from 5 per cent to 10 per cent of a low melting point alloy which melts at a temperature of approximately 650° F. and comprises zinc 93 per cent, aluminum 4 per cent, and copper 3 per cent.

The following references are of record in the file of this patent: United States Patents: 2,205,180, Shaver, June 18, 1940, and 2,205,181, Shaver, June 18, 1940. Other References: *The Iron Age*, New York, vol. 130, Nov. 10, 1932, page 721. "Medium Temperature Salt Baths," Eddy. (Copy in Scientific Library.)

INSTITUTE TO CONDUCT INDUSTRIAL RESEARCH

Southwest Research Institute, a non-profit scientific organization designed to aid Southwestern industry solve its technological problems, recently opened its laboratories and has already contracted for several projects sponsored by industrial corporations.

Dedicated in September by its trustees and Tom Slick, San Antonio oil man and rancher who endowed it for more than $1,000,000, the Institute was built along lines of Midwest, Armour and Mellon Institutes to conduct industrial research on a fee basis. Under its charter, sponsoring manufacturers or trade associations retain patent rights on all discoveries accruing from research projects.

Located on famed Essar Ranch, four miles west of San Antonio, the Institute provides technological facilities intended to assist in improving manufacturing processes, solving industrial engineering problems, developing new materials or products, improving agricultural production, analyzing biological or chemical problems, reducing manufacturing costs, solving industrial-chemical problems, exploring chemurgical potentialities, and discovering new uses for by-products or wastes.

Principal members of the Institute's beginning staff include Acting Director and Business Manager W. M. Hammond, formerly business manager for Armour Foundation; Dr. H. C. Dyme, chemist and bacteriologist; Dr. John B. Loefer, biologist and authority on microorganisms; Robinson Brown, graduate mechanical engineer and oil equipment expert; Dr. Judson Swearingen, chemical engineer and authority on hydraulics and turbines; Dr. Paul A. Keesee, veterinarian known for his work in artificial insemination; Dr. F. W. Bieberdorf, botanist and authority on plant pathology; I. O. Gilbert, specialist in electronics and machine design, and their assistants.

The first laboratory, functionally designed and equipped with the most modern instruments and machines, houses chemical and biological laboratories, engineering department, a complete machine shop with foundry, forge, tin shop, welding and heat treating equipment, an animal room, and various cold rooms, sustained humidity rooms, a self-contained power plant, distillation plant, and other scientific facilities. A separate, underground vault for storage of volatile chemicals is located nearby.

A charitable and educational organization, the Institute also assists deserving students of science by opening its laboratories to them and employing a limited number as assistants to staff technologists, thus providing them with practical experience of the highest order.

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FERRO CHEMICAL CORPORATION

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(Subsidiary of Ferro Enamel Corporation)

Union Commerce Bldg. Cleveland 14, Ohio

PACIFIC COAST A. C. S. REGIONAL MEETING . . .

(*Continued from page* 568)

container, is evaluated in terms of either its length of life or the number of trips before failure. Although failure is generally due to impact, minor damage in service determines in large measure the amount of impact required. Assuming that the weakening effect of service and the final impact causing fracture are separate and independent processes, a mathematical treatment is evolved that quite accurately expresses the age-breakage relation for tumblers in a restaurant.

Basic Refractories, Their Manufacture and Application. *By R. C. Hanson, E. J. Lavino & Company, Philadelphia, Pa.*

This paper discussed in a general manner the sources and composition of the raw materials used in the manufacture of basic refractories and the major products now available in commercial quantities. Production and Production Control Methods were illustrated with slides showing a flow diagram and views of a modern plant. A section was devoted to research and development work in this specialized field of ceramics, listing the various equipment and tests that are necessary to maintain quality control and establish new raw materials and products. Slides were also presented that showed the principal applications for basic refractories in the steel, non-ferrous, rock products and steam generation industries.

Some Problems in Withdrawing Ceramic Raw Materials from Elevated Bins. *By D. E. Postlewaite, Universal Sanitary Manufacturing Co., Pacific Pottery Division, Redlands, California.*

Ceramic raw materials including ball clays, china clays, powdered flint and Feldspar and crushed body scrap stored in elevated concrete bins were found difficult to withdraw by gravity feed alone. Moisture content of the materials in storage adversely affected the flow characteristics. Poke holes and air jets were rather ineffective on clays and it was necessary to use a man with a shovel on the inside of the bin to break off arching and keep material flowing through the discharge. An electro-vibrator and a sheet metal liner on sloping areas of the bin proved effective in discharging clays. The same arrangement of vibrator and metal liner plate plus a triple screw feeder which gave a much larger effective area for withdrawal proved effective in the non-plastic bins. Air lines installed in flint and Feldspar bins provided with many small jet holes successfully aerated powdered material to aid in flow but allows material to seep through very small openings. An enclosed screw conveyor is superior to a belt conveyor in handling powdered non-plastics as this type of material tends to flow like water and spill off sides of a belt conveyor.

W. E. BLACK NAMED ASSISTANT SUPERINTENDENT

Ball Brothers Company has announced the appointment of Walter E. Black as assistant superintendent of plant services at the Company's Muncie factory.

Mr. Black, a native of Clarinda, Iowa, came to Ball Brothers as a management trainee in April 1946. For two and a half years he was associated with the E. I. DuPont de Nemours Company at Deepwater, New Jersey.

DOMINION GLASS BUILDS BOTTLE PLANT ADDITION

The Dominion Glass Ltd., Montreal, Quebec, has started to build a $400,000 bottle plant addition at Hamilton, Ont., Canada, this being a two stories addition of reinforced concrete and expected to involve a substantial increase in capacity as well as employment.

The engineer is E. H. Darling and the contractor is W. H. Cooper Construction Company.

Then you'll want to investigate Ferro's acid-resisting, applied glass colors—with wide firing range, high gloss and good coverage. Write today for further details.

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BUILDING finishing coat and base coat plaster, mortar, concrete, germicidal washes and paints.

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INDUSTRY in the making of glass; in the steel industry; innumerable chemical processes; water treatment.

NATIONAL MORTAR & SUPPLY COMPANY
Grant Building Pittsburgh, Pa.
Established 1907

Essentially yours
Banner Lime
FAMOUS OHIO DOLOMITE

FIRST GLASS BLOCK PLANT IN WEST IS OPENED

Over 15,000 people from numerous western Missouri towns jammed through Pittsburgh Corning's new $2,000,000 glass block plant in a two-day formal opening held Sunday, September 28 and Monday, September 29, according to O. W. Wiley, plant manager.

Every section of the plant was opened for public inspection and the numerous plant operations were explained to the spectators.

The new glass block plant is part of an expansion program being undertaken by Pittsburgh Corning. Under construction is a new plant for manufacture of Foamglas insulation. The company also has glass block and Foamglas plants at Port Allegheny, Pennsylvania.

GENERAL ELECTRIC COMPANY AIDS GRADUATES

For the twenty-fourth consecutive year the General Electric Company will grant aid to college and university graduates wishing to undertake or continue research work in scientific and industrial fields.

Applications are now being accepted for the scholastic year 1948-1949 for grants under the $1,000,000 G-E Educational Fund, from the income of which the fellowships are awarded, according to W. W. Trench, company secretary and chairman of the Education Committee.

Applications, which may be obtained from A. D. Marshall, secretary, General Electric Educational Fund, Schenectady, N. Y., will be passed on by a committee representing various scientific and industrial societies and institutes.

POLISH GLASS PRODUCTION

The Polish glass industry now comprises 38 glass factories producing about 100,000 tons valued at $20,000,000, of which (1946) $2,000,000 worth was exported. The annual production of plate glass (80 million sq. ft.) is over 50 per cent higher than before the war. The hollow glass production is small. (50,000 tons, 1938: 100,000 tons). The optical glass production is surprisingly large and a noticeable source of exportation. The most important plant is in Jelenia Gora. The present production of lenses and scientific glass will expand during 1947 to include prisms, filters and instruments. Orders have been placed by Czechoslovakia, Switzerland and Scandinavia.

OWENS-ILLINOIS PACIFIC COAST APPOINTMENTS

Important assignments in the Pacific Coast Division of the Owens-Illinois Glass Company have been announced by Owens-Illinois officials.

C. G. Bensinger, Vice-President and General Factories Manager of the Glass Container Division, has been appointed Vice-President and General Manager of the Pacific Coast Division with headquarters in San Francisco. In his new position Bensinger will have full responsibility for all Pacific Coast operations.

Mr. Bensinger has announced the appointment of Kenneth C. White, former Sales Promotion Manager of the Glass Container Division, as General Sales Manager of the Coast Division with headquarters in San Francisco. Mr. White has been associated with the glass industry since 1927.

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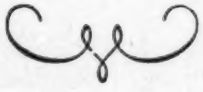
• By placing your order now a bound volume of THE GLASS INDUSTRY for 1947 will be reserved for you. The supply is limited therefore, copies must be reserved as orders are received. All twelve issues are attractively bound and with the annual index serve as an indispensable reference medium to all technical and production problems of glass manufacture. Price $7.50.



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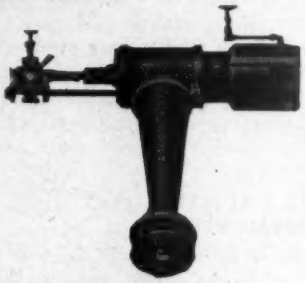

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AN ELECTRICALLY HEATED GLASS TANK . . .

(*Continued from page* 573)

are so common in the usual sheet glass. Air bells were the only frequent defect of the electrically produced glass.

After-treatment

The sheet is cut immediately after emerging from the machine when it is still hot. The panes are transported in trolleys from the second floor of the machine room to the packaging department where they are assorted according to kind, thickness and size. The packaging department is connected with the shipping department, situated on the ground floor, by an inclined open channel. Packaged glass is carried down along this channel. The floor of the shipping department is on the level of freight railroad cars. A railroad siding passes next to the main building.

GLADDING APPOINTED SUPERINTENDENT BY SWINDELL

Swindell Brothers, Inc. has announced the appointment of A. M. Gladding as General Superintendent of their factories at Baltimore, Maryland.

Mr. Gladding is a graduate of the Johns Hopkins University, School of Engineering. He joined Swindell Brothers, Inc. in 1935 as an engineer. He was ordered to duty in the U. S. Army in 1940 as 1st Lt. C. E. He completed his duty in 1946 as Lt. Col. C. E. During this time he spent over two years in the E. T. O. Since his return from the Army, Mr. Gladding has been Research Engineer for the Corporation.

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RESEARCH DIGEST . . .
(*Continued from page* 579)

An experimental approach to the study of the effect of surface tension on the fining rate, that is, the rate of removal of bubbles by their rise to the surface, was attempted by Appen, who used syrups of different surface tensions but of the same viscosity. He found a positive correlation between fining time and surface tension, that is, the syrups with higher surface tension took longer to fine.

Shartis and Smock (April 1947 issue of the *Journal of the American Ceramic Society*) have measured the surface tension of a number of optical glasses made at the National Bureau of Standards by a modification of the anchor ring method. The values for the flint glasses at 1300° C. were in the range 210 to 230 dynes per cm; the barium crowns ranged from 260 to 310, while the other types of glasses had intermediate values. Most of the glasses had positive temperature coefficients of surface tension. The surface tension values increased with the increasing periods of time at which the glasses were maintained at high temperatures immediately prior to measurement. Positive rank correlation coefficients of statistical significance were found between seed quality of optical glasses and such factors as surface tension, pot attack and amount of gas liberated during the melting process.

• The Wickwire Spencer Steel Division of the Colorado Fuel and Iron Corporation has announced the appointment of L. J. Renner as District Sales Manager, Chicago, Illinois.

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Glass Work

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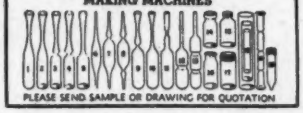

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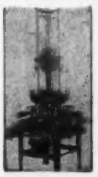
BULB BLOWING MACHINES—BASING and SOLDERING MACHINES



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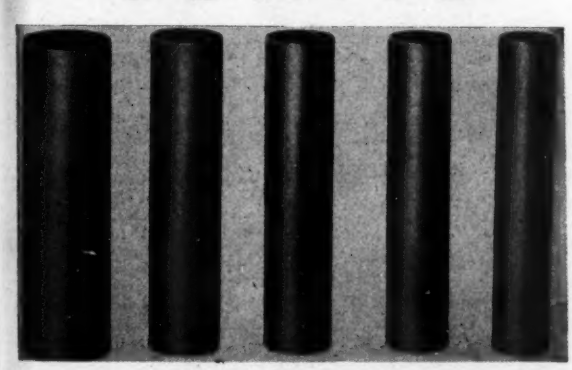

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BOTTLE FACTORY SUPERINTENDENT WANTED—A capable man is wanted to supervise and control machine operations in every detail in a large glass plant. This factory is located in the midwest and has Hartford I. S. Machines in operation. The position entails full responsibility, therefore experienced man only should apply. Write personal details, experience, education, age and remuneration required, in confidence. Address Box 66, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

PRODUCTION MANAGER wanted by medium size Glass Container firm manufacturing a general line of medicinal, toilet and proprietary bottles. He must have necessary experience in supervision of men and a thorough knowledge of operating Hartford-Empire equipment. Give full particulars, including age and salary expected, when applying to Box 64, c/o The Glass Industry, 55 West 42nd Street, New York 18, N. Y.

Experienced man to take charge of Selection and Packing Department in modern West Coast glass plant, manufacturers of wide mouth and narrow neck ware. State age and experience. Reply Box 67, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

REPORT DESCRIBES TWO LENS-EDGING MACHINES

Two German self centering lens-edging machines and test results of their operational efficiency as determined by the Ross optical firm in London are described in a British Intelligence Objectives Sub-Committee report now on sale by the Office of Technical Service, Department of Commerce.

The principle underlying the self centering edging machine has been known for many years, the report states, but has never been widely used in the optical industry. Following an investigation of the German optical firm, Voigtlander and Sohn at Brunswick, Germany, British experts evacuated two machines, a Bothner self centering edging machine, and another made by Voigtlander. In London, a thorough comparative study of the design, construction, operation and performance of both machines was made.

Orders for the report (PB-79190; Report on the Bothner Self-Centering Edging Machines; photostat, $3; microfilm, $1; 35 pages) should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order, payable to the Treasurer of the United States.

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